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WHY ACCIDENT DATA?

By

William E. Tarrants

Chief, Manpower Development Division,
Office of State Program Assistance,
Traffic Safety Programs,
National Highway Traffic Safety Administration

Presented at Workshop on Data Analysis and
Problem Identification, Washington, D.C.,
May 1975

ABSTRACT

The essential importance of statistics to the traffic safety field is described. The traffic safety movement began with statistics developed to identify the problem, grew as statistics provided the basis for accident prevention decisions, and lives today because statistics have shown the positive results of these prevention efforts. Researchers generally recognize five stages which recur in intelligent problem solving: planning, observation, hypothesis, prediction, and verification. Desirable improvements in five areas of the accident statistics field are described: the validity and reliability of accident data; additional problem identification and decision-making information, along with instructions concerning its meaning and use; data analysis procedures; scientific procedures necessary for making causal determinations; and a better understanding of the traffic safety field.

of the need for highway safety programs are based upon evidence that accident problems exist and that their existence is of some vital importance? The thoughts and actions of countless individuals and organizations are strongly influenced by accident data. They show conclusively, in continuing analysis, that accident problems exist and that their existence has a profound influence on the nation's human and material resources.

Now, what if these data—these “statistics”—were not available? It seems quite reasonable to speculate that, in the absence of a means of identifying the accident problem, your interest, the interest of State governments, and the interest of the general public in accident prevention would be greatly reduced, possibly nonexistent, unless someone close at hand or perhaps you yourself were involved in an accident. Actually, traffic accidents are rare events in the life of any given individual and few persons can form any clear understanding of their importance as a social and economic problem solely from their own experience. Statistics of the kind I have just described expand the scope of accident knowledge and create a realization that there is a problem in urgent need of solution. The traffic safety movement began with statistics developed to identify the problem, grew as statistics provided the basis for accident-prevention decision-making activity, and lives today because statistics have shown the positive results of these prevention efforts and have created and stimulated the urge to action!

Why do we need accident data? A simple, yet far-reaching answer to this question is that the entire traffic safety movement was born, grew in stature, and lives today because of data. Furthermore, the safety movement as we know it would most surely die if statistical data were not available to provide the nourishment, the energy, and the guiding force in support of the nation's traffic accident prevention efforts.

Let's take a look at a few points in fact. Isn't it true that your acceptance and the nation's acceptance

If we accept the premise that the safety movement must have injury and accident statistics, the next question we might ask is what responsibilities do the State and Federal Governments have for providing such statistics? I'm sure the answer is obvious. Only governments have the resources to produce the comprehensive basic statistics needed to identify the problems and measure progress. Outside of government there are, of course, many special statistical activities, some of a continuing nature, which serve particular purposes and are most useful to the safety movement. But these sources provide limited information and the data are usually collected from a relatively narrow segment of the population. State and Federal highway safety agencies all have a statutory duty to foster and promote the welfare of all vehicle operators, passengers, and pedestrians; and keeping the traffic safety movement alive and vigorous is of the essence in such a responsibility. Unfortunately, only a few State agencies have been given adequate resources to do properly the task they should be performing in this area.

A second question we might ask ourselves is, given adequate resources, how can we best achieve our statistical service objective? Progress evolves from a restless discontentment with even the best of what is currently practiced. It is not enough just to pull ourselves up to the currently acceptable level of performance. If we are to achieve more effectively the objectives of accident prevention we need to appraise continually our present statistical methods with a view toward their improvement. The answer to the question "Why accident data?" takes on new dimensions when we also ask "Where do we go from here?"

A close examination of our present activities in the accident statistics field reveals several areas where improvements might be introduced:

I. We need to improve the validity and reliability of accident data.

Statistics has been defined as a body of methods for making wise decisions in the face of uncertainty. The quality of the statistics and, ultimately, the quality of the decisions made from them are dependent upon the quality of the information from which they are derived. Some go so far as to state that there are no bad decisions, only bad information. If all of the facts are known, the decisions often suggest themselves. In the context of accident prevention applica-

tions, wrong or inadequate information about accident causes leads to wrong decisions concerning what countermeasures to recommend.

The quality of decisions is a direct function of the validity and reliability of the information upon which the decisions are based. Our accident statistics will improve as we develop better data collection methods, improve our population sampling techniques, establish more precise causal classification categories, and improve our system for checking the validity and reliability of the reported accident information.

II. We need to present additional problem identification and decision-making information along with instructions concerning its meaning and use.

Statistics serve in at least two capacities. First, they provide methods for organizing, summarizing, and communicating data. Second, they provide methods for making inferences beyond the observations actually made to statements about large classes of potential observations. The set of methods serving the first of these functions is generally called *descriptive* statistics. Most of the accident and injury statistics presented by State and Federal governments are descriptive in nature. But if we wish to generalize from our knowledge of a sample to the population of which the sample is only a fraction, we need a body of methods which will enable us to arrive at conclusions extending beyond the immediate data. The techniques that enable us to draw inferences about population from our knowledge of samples are called *inferential* statistics. Our ability to make objective decisions is greatly enhanced when techniques of inferential statistics are introduced. They not only aid us in determining what inferences we can draw, but also how confident we are in drawing them. The addition of this new decision-making information to our body of accident and injury statistics will tell us our margin of error when we predict some population measure such as an accident frequency rate and will enable us to test hypotheses about various measured relationships within the population. Actually, the purpose of description is to prepare the way for inference. In practice, inferential statistics are perhaps much more important than those of a descriptive nature. We must study samples, but we are seldom interested in the samples themselves. Inferential statistics permit us to go beyond our data and tell us how much risk we take in doing so. Addi-

tional information which would enhance our inferential capability and greatly aid the user in making decisions include measures of dispersion such as the standard deviation, the variance and the range; and procedures for testing hypotheses such as the t-ratio, the chi-square test, and analysis of variance.

III. We need to improve and expand our data analysis procedures.

This point ties in closely with the presentation of additional decision-making information. In analysis work, we need to apply the techniques of inferential statistics to put new meaning in the data interpretation process. Data analysis is probably the weakest link in the accident statistics development system. It is important to keep in mind that statistical data have to be interpreted; they seldom, if ever, "speak for themselves." Statistical data in the raw simply furnish facts for someone to reason with. They can be extremely useful when carefully collected and critically interpreted. But unless handled with care, skill, and above all, objectivity, statistical data may seem to prove things which are not at all true. It is sometimes said that statistics are used the way a drunk uses a lamppost: for support, rather than for light. Special care must be taken in analysis not to bias the results because of personal interpretations and conclusions that are unwarranted by the nature of the original data itself. The frequently heard comment that statistical conclusions are wrong is often supplemented by the view that when they are not wrong they are self-evident and trivial. A statistician has been defined as "... a person who draws a mathematically precise line from an unwarranted assumption to a foregone conclusion."

Misuses and misinterpretations in the analyses of statistics are probably as common as valid uses. Darrell Huff in his interesting book "How to Lie With Statistics" and Allen Wallis and Harry Roberts in their book "Statistics: A New Approach" have made excellent presentations of statistical fallacies and errors in data analysis. They describe errors in the use of basic definitions underlying an investigation, in the application of those definitions in the measurement or classification of individuals or objects, and in the selection of individuals for measurement. They also illustrate errors in the use of the resulting data by making comparisons improperly, by failing to allow for such indirect causes of differences as heterogeneity

of groups with regard to important variables, by disregarding the variability that is usually present even under apparently constant conditions, by technical errors, and by misleading verbal or graphical presentations.

IV. We need to understand and apply the scientific procedures necessary for making causal determinations.

Ideally, data collection and analysis represent an attempt to utilize the scientific method for the purpose of identifying problems and assessing the worthwhileness of various alternative solutions or countermeasures. The more we can satisfy the rules of scientific methods in designing a data collection system and conducting data analysis, the more confidence we can place on the objectivity of our findings.

Researchers generally recognize five stages which recur in intelligent problem solving:

1. *Planning* (Including problem identification and analysis). We actually define the problem and establish its parameters in the planning stage. Planning involves clarifying objectives, establishing policies, selecting specific countermeasures, establishing procedures, mapping programs and campaigns, and setting up day-to-day operational schedules. It is essential that planning also include establishing procedures for evaluating program effectiveness so that cause-and-effect determinations can be made. The preferred causal analysis technique involves experimental and control groups and the random assignment of a representative sample of individuals to each of these groups. This analytical model should be "built-in" at the planning stage. Planning also includes the selection of at least one criterion of effectiveness and the prescription of appropriate methods of measurement.

2. *Observation*. The data analyst observes what happens as the independent variable (the new program or countermeasure) is introduced to the experimental group and the dependent variable (criterion) changes or remains stable over time.

3. *Hypothesis*. In order to explain the facts observed, conjectures are formulated into a hypothesis or tentative proposition expressing the relationships believed to have been detected in the data. In formulating hypotheses, prime consideration must be given to the criterion or measurement standard to be used in conducting the analysis.

4. *Prediction.* Based on the hypothesis or theory, we make deductions concerning the consequences of the hypothesis we have formulated. Here is where experience, knowledge, and perspicuity are important. Predictive reasoning can help lead us to more basic problems as well as provide operational or testable implications of the original hypothesis. At this stage we are anticipating or predicting what will be seen if certain observations not yet made are made.

5. *Verification.* The data analyst collects new data and tests the predictions made from the hypothesis. The essence of verification is to test the relation among the variables identified by the hypothesis. In hypothesis testing we are interested in measuring the risk of incorrect interpretation objectively in terms of numerical probabilities. The procedures of statistical hypothesis testing enable us to determine, in terms of probability, whether the observed difference in the measured criterion is within a range which could easily occur by chance or whether it is so large that we can be confident that the differences are actually significant.

What is important in this procedure for the highway safety program administrator is the overall fundamental idea of scientific problem solving as a controlled rational process of reflective inquiry. Data analysis methodology applied to accident control problems enables the safety program administrator to gain knowledge through the use of experiments as opposed to intuitive speculation and the application of "trial and error" prevention methods. A test of a hypothesis is a means of determining the validity of some prediction or expectation. Establishing a working hypothesis is an important step in control planning. It suggests the kinds of data needed and how they should be arranged and classified. It also establishes the basis for making programming decisions.

There are, of course, numerous practical problems associated with actual application of analytical methods in a given situation. In our evaluation of safety program effectiveness, the primary objective is to determine the extent to which a given program or countermeasure is achieving some desired result. The "success" of our data collection and analysis system is largely dependent upon its usefulness to an administrator in reducing accident losses (e.g., deaths, injuries, property damage, costs, etc.). Thus, while scientific criteria may determine the degree of confidence we may place on the findings of an appraisal

study, administrative criteria will play an even larger role in determining the usefulness of the study once it has been done. In our applied data collection and analysis activities, we must be constantly aware of the potential utility of our findings. Similarly, the use which we intend to make of the data (the kinds of decisions we expect to make), should determine the type and quantity of data we are seeking. We should begin by defining our decision-making information needs, then proceed to define the kinds of data we need to make those decisions. Collecting data that are not needed for decision making is wasteful and unnecessary. We should avoid institutionalizing our data collection system to the point where removing obsolete information becomes difficult if not impossible. Collecting data continually which provide us over and over again with information we already know is a useless exercise. We need to use a rifle approach aimed directly at the target problem instead of a shotgun aimed in the general direction of the issues of concern.

There are numerous experimental designs which can be used in evaluating highway safety program effectiveness, each having its strengths and weaknesses in relation to the need for decision-making information. There is no perfect design that fits all situations. Some evaluation specialists make a distinction between the experimental and the so-called *ex post facto* approach to information gathering. The experiment is a scientific form of inquiry in which the evaluator manipulates and controls one or more independent variables and observes one or more dependent variables for evidence of change. For example, a public education program designed to increase driver usage of lap and shoulder safety belts can be identified as the independent variable, and the change in safety belt usage as measured by behavior sampling techniques would be the dependent or criterion variable. In this experiment, we attempt to change the behavior of drivers by means of the public education program focused on a specific action target, and we evaluate the effect of this program by observing the subsequent change in behavior.

In *ex post facto* evaluation something is done or occurs after an event with a retroactive effect on the event. In this kind of evaluation study the independent variable or variables have already occurred. The evaluator starts with observations of the criterion and retrospectively studies the independent variables

to determine their possible effects on the criterion or dependent variable.

The traffic policeman who investigates an accident is, in effect, conducting *ex post facto* evaluation. He examines certain evidence and retrospectively studies the independent variables; in this case, the behavioral, vehicular, and environmental factors which he believes were causally related to the accident result. Most of our present day safety program activities are based on similar after-the-fact appraisals of losses or crashes which have already occurred. It should be clear that a more desirable model for accident problem analysis is the controlled experiment since the investigator can have more confidence that the relationships he discovers are really significant in terms of their cause-and-effect implications.

One of the preferred evaluative techniques involves the use of a control group. Comparison groups are necessary for the internal validity of any evaluation program. The purpose of the control group is to rule out variables that are possible "causes" of the effects we are studying other than the variables we hypothesized to be the "causes." In other words, we want to control extraneous sources of influence on the criterion variable. The control of extraneous variables means that the influence of independent variables extraneous to the purpose of the study is minimized or nullified. One way of controlling extraneous variables is by randomization. By randomly assigning subjects to the experimental group and the control group, we are able to assume the pre-experimental approximate equality of these two groups in all possible independent variables.

One of the major weaknesses in much of the evaluative research conducted in the highway safety field has been the lack of adequate controls. We frequently encounter so-called "research" evidence which supports conclusions based on uncontrolled observations of certain characteristics of persons involved in accidents. For example, in an investigation into one aspect of the motor vehicle accident problem, violations of traffic regulations by drivers in fatal crashes, it was shown that nearly one third were exceeding the speed limit at the time of the accident. Another study concluded that in over 50 percent of all fatal accidents occurring in a particular region the driver had been drinking. Still another study concluded that the majority of drivers involved in one-car crashes were smoking a cigarette. Such statements contribute very little to

our understanding of the problem unless it is known whether the cited characteristics of the accident involved drivers are present to a different extent among those who are not involved in accidents. Such data are also frequently biased because of the tendency of those investigating accidents to conclude that the occurrence of an accident is sufficient evidence that such violations and characteristics were present. These conclusions are then used in a circular fashion to support pre-existing biases concerning accident causes. In scientific evaluation it is important to compare the characteristics of accident cases with the characteristics of the corresponding populations and situations from which they are derived.

In attempting to establish a "cause-and-effect" relationship between the introduction of a countermeasure and a subsequent reduction in the safety program effectiveness criterion, we often fail to consider the "regression-to-the-mean" phenomenon. The phenomenon of regression-to-the-mean describes the fact that when successive samples are selected from a population and certain variables measured, there is a tendency for these variables to return from the extreme to an average condition as repeated measures are taken. If we select 10,000 samples of drivers with respect to accident record, we would find that some samples would have a no-accident record, some samples would have around an average record, and some would have a bad record. If we subsequently sampled the same groups in a second time period, we would find that some of the groups with a bad driving record the first time would continue to have a bad record, some would get better, and some would get worse. In general, it would be seen that the samples exhibiting the extreme characteristics in the first instance would tend to exhibit less extreme characteristics in the second instance. Drivers who tended to perform poorly in the first observation would tend to improve in the second, while drivers who performed exceptionally well in the first observation would tend to get worse in the second. We can conclude from this phenomenon that so-called "poor drivers" identified in one time period will tend to show an apparent improved record during a second time period, regardless of whether a countermeasure or program activity was introduced or not. Thus an apparent improvement during the period following the introduction of a countermeasure may be falsely attributed to the effects of the countermeasure when, in fact, the natural tendency for sample measures to regress toward the mean may be produc-

ing the shift in criterion values. A second or "control" group which is equally as poor but is not exposed to the countermeasure may show the same improvement, even though nothing at all was done to influence this change.

The informed interpreter of evaluation results, armed with his knowledge of evaluative techniques, can readily identify these sources of bias, or at least suspect their presence when no mention is made of the frequency distributions of the same characteristics among appropriate control populations.

The following steps are essential for evaluating safety program effectiveness:

1. Formulation of the program, countermeasure, or project to be evaluated.
2. Definition of the program, countermeasure, or project goals and objectives.
3. Analysis of the specific problems which must be addressed by the program, countermeasure, or project.
4. Application of the program, countermeasure, or project within a specific problem area, with the use of control groups as appropriate.
5. Measurement of the degree of change in the evaluative criterion.
6. Determination of whether the observed change is due to the program, countermeasure, or project, or to some other cause.
7. Determination of the durability of the effects of the program, countermeasure, or project.

This application of the "scientific method" to safety program appraisal provides the most promising means for determining the relationship between a specific safety program activity or countermeasure and functional safety performance objectives in terms of predetermined measurable criteria.

Techniques for evaluating safety effectiveness are tools, and like all tools, to be effective they must be designed for a specific function. It seems obvious that the need in safety program evaluation today is for more scientific evaluation. Greater progress in accident prevention will be made when we attempt to examine the objectives of a particular program, including underlying assumptions, develop measurable criteria specifically related to these objectives, and set up a controlled situation to determine the extent to which these objectives, and any negative results, are actually achieved.

V. We need to acquire a better understanding of the traffic safety field.

The final area of improvement which we should consider with regard to accident data is the need for a better understanding of the field within which our results are applied. Statistics is a tool which can be used in attacking problems that arise in almost every field of empirical inquiry. The statistical approach, though universal in its underlying ideas, must be tailored to fit the peculiarities of each concrete problem to which it is applied. It is dangerous to apply statistics in "cookbook style," using the same recipe over and over, without careful study of the ingredients of each new problem. We may be especially interested in statistical methods, but it is important to recognize that statistics cannot be used to full advantage in the absence of a good understanding of the subject to which they are applied. Successful statistical work depends greatly on knowledge of the subject matter. Mere manipulation of figures or preparation of standard tables and graphs is seldom fruitful unless guided by a clear conception of the subject matter and of what relations would be worth looking for. To a considerable extent statistical application in any particular field is an art, rather than a science. As with other arts, however, there are certain basic techniques whose mastery is necessary, though not sufficient, for success.

As a final thought, I would like to quote from an article on statistics in general by George Hagedorn, Director of Economic Studies of the National Association of Manufacturers. He said: "People who really understand the figures, their virtues and their limitations, are a small minority. The great majority, who do not understand the data, are divided into two classes. First there are those who have an exaggerated respect for government data. They assume that only you put the right statistics together there will emerge from this compilation of *facts* the right answer to any given problem.

"The second group is composed of those who have an exaggerated *suspicion* of published government data. In this view, since government officials frequently cite statistics in support of their partisan and questionable proposals, there must be something wrong with the statistics themselves."

Mr. Hagedorn continues: "The truth lies somewhere in between. The figures published by the old line statistical agencies are generally prepared in an honest

and competent manner. But, no matter how honestly and competently the figures are prepared, it is a mistake to imagine that government statistics are facts which *speak for themselves*. They speak clearly only to those who have taken the trouble to investigate the definitions on which they are based and the techniques used in preparing them. And they give answers to economic questions only when they are combined with a good measure of common sense, knowledge of non-statistical facts, and a basic understanding of what makes our economy work."

To government statisticians, this means that not only must they produce the most valid and reliable data

possible, but also that they must make sure that standard procedures are followed in compiling the figures, that professional competencies in the analysis of data are properly applied, and, above all, that they must fully explain and be willing to defend their data development and analysis procedures. We must be humbly conscious of the fact that we do not know all the answers. When these principles are put into practice, we can feel confident that we are doing our part to provide the data base for management decision making which will keep the traffic safety movement alive, vigorous, and successful.

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ABSTRACT CITATIONS

HS-018 815

VISIBILITY OF TRAFFIC CONTROL DEVICES-- CATERING FOR THE REAL OBSERVER

Visual characteristics of the 'real' observer using both conventional methods of assessment and an information theory approach are reviewed with regard to traffic control device design. A gulf exists between what the design engineer expects users to be able to see and the actual visual performance of the user population under practical conditions. A significant proportion of an unselected user population exhibits defects of vision which result in less than normal visual performance for the system. Present scales for specifying visual performance do not adequately represent the visual requirement of many practical tasks. A more systematic approach to the development of design rules based on visual performance characteristics of the whole user population rather than only that proportion of the population which has normal vision (should be developed). Equally there should be a more purposeful and systematic approach to the imposition of minimum visual standards to ensure that observers maintain a level of visual capability adequate for the designed task.

by A. W. Johnston; B. L. Cole; R. J. Jacobs; A. J. Gibson
Victorian Coll. of Optometry, Australia; Dept. of Optometry
Univ of Melbourne, 374 Cardigan St., Carlton, Vic., Australia
3053

1977; 30p 26refs

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95250 and 93240 and by the Dept. of Civil Aviation.

Availability: Corporate author

HS-018 816

HITCHHIKING: A SURVEY OF PROBLEMS AND SOLUTIONS

A survey of hitchhiking risks covers six subject areas: resultant traffic problems; crimes against both hitchhiker and driver; changes in numbers of hitchhikers over the past five years; statistical methods used in the field; hitchhiking laws and their effectiveness; and a description of Poland's method of licensing hitchhikers. Statistical data are limited; it is recommended that both state agencies and the FBI increase their data-collection activities. Criminal danger is greater for the hitchhiker than for the driver. The hitchhiker as a pedestrian both causes accidents and is the victim of others. Hitchhiking laws deal with keeping the hitchhiker off the traveled portion of the road, and are not well designed to avoid the confrontation between driver and hitchhiker - the consequences of which are more serious than the accident risk as a pedestrian. The laws of 40 states and the District of Columbia are compared with the Uniform Vehicle Code. The Polish system of licensing hitchhikers, which involves registering of hitchhikers, issuance of a sort of passport from which the hiker gives coupons to the driver (which function as lottery tickets for the driver), is not considered appropriate for adoption in the U.S. because of differing sociological characteristics. The questionnaire used in the survey is presented as an appendix; States for which data are tabulated and most frequently discussed include Oregon, Washington, Wisconsin, New Jersey, Illinois,

Massachusetts, New York, Ohio, Pennsylvania, Wyoming, Connecticut, Delaware, and Kansas.

by Melvin C. Mooers

1975; 51p 72refs

Research paper, in partial fulfillment of the requirements for a
Certificate in Traffic Police Administration, Traffic Inst.,
Northwestern Univ.

Availability: Traffic Institute, Northwestern University

HS-018 817

GUIDELINES ON THE OPERATION OF SUBSCRIPTION BUS SERVICES

The planning, organization, and operation of specialized bus services, termed subscription are described. These are tailored to serve urban travelers who agree to patronize them on a regular basis. Based on ten detailed case studies of such services (presented in an appendix), the report develops guidelines on identifying, informing, and attracting potential riders, obtaining vehicles, and drivers, meeting regulatory requirements, setting routes, schedules, and fares, and obtaining special privileges such as the use of express lanes and close-in parking. In overview, these guidelines suggest that the following characteristics are critical to the successful operation of subscription bus services: a relatively large concentration of at least 50 fairly long trips with proximate origins or destinations and common, regular schedules; a dedicated organizational body to formulate the service and manage it on a continuing basis; a high degree of reliability in the provision of the service; careful attention to regulatory requirements, which may vary considerably; continual adjustment of routes and schedules in response to changes in demand; and the provision of personalized service features, such as guaranteed seating, door-to-door service, and express ride. The report concludes with a discussion of the potential impacts of these services on the congestion, pollution, and fuel consumption associated with urban travel: specifically, formulas for making such calculations and the matter of justifying recommendations.

by Ronald F. Kirby; Kiran V. Bhatt

Urban Inst., 2100 M St., N.W., Washington, D.C. 20037

Contract DOT-UT-40008

Rept. No. UI-5021-4; PB-237 076 ; 1974; 75p 13refs

Availability: NTIS \$4.75

HS-018 818

A MANUAL FOR PLANNING PEDESTRIAN FACILITIES

This manual provides the urban planner and the highway engineer with the basic considerations necessary to plan pedestrian facilities or systems of facilities. Included are the basic concepts in pedestrian trip generation and movement, and basic types of facilities available to the planner, categorized by horizontal, vertical, and time separations. Advantages and disadvantages of each are given, and each of the types of impacts to users and nonusers of pedestrian facilities is discussed. First-order impacts are those experienced by the pedestrians who use the pedestrian facilities, and are the causative factors including people to use or to avoid them. Second-order impacts are those experienced by others directly affected by changes in pedestrian circulation patterns, e.g., motorists and

occupants of abutting properties. Third-order impacts are those experienced by the locality in the forms of increased property tax revenue from higher property values, demands for parking, and provisions for security. An approach to general economic cost estimating in terms of both construction cost and continuing operating and maintenance costs is described; the first three steps involve estimation of construction costs, paying attention to facility characteristics, site characteristics, and geographical and temporal adjustments. Computation formulas are given. Operating and maintenance costs are also considered, although not in as much depth. There are several means of converting these various costs to a figure useful in comparing facilities and evaluating benefits, such as the present value method and the equivalent uniform annual cost method.

by J. C. Prokopy
Peat, Marwick, Mitchell and Co.; TKL Associates Inc., 1025 Connecticut Ave., N.W., Washington, D.C. 20590
Contract DOT-FH-11-7966
Rept. No. Implementation-Package-74-5; 1974; 79p 22refs
Summary prepared from "A Comparison of Costs and Benefits of Facilities for Pedestrians" by W. G. Scott and L. S. Kagan.
Availability: NTIS

HS-018 819

RESPONSE OF THE HUMAN NECK IN FLEXION, EXTENSION AND LATERAL FLEXION. FINAL REPORT

The responses of the human neck in forward flexion (0°), lateral flexion (90°) and oblique lateral flexions (45° and 135°) were studied using human volunteers as test subjects in both static and dynamic environments. The shear reaction and torque at the occipital condyles were obtained. Static results show that when the neck is in its upright position, a maximum voluntary neck torque is 37.0 ft-lbs in 0° flexion; 15.0 ft-lbs in 180 degree extension; 35.0 ft-lbs in 90° lateral flexion; 40.5 ft-lbs in 45° flexion; and 24.0 ft-lbs in 135° flexion. For dynamic exposures, the maximum neck torque was 34.5 ft-lbs in the 0° flexion and 22.5 ft-lbs in the 180° extension. The neck response curves for the 0° flexion and 180° extension runs are all within the envelopes established by Mertz and Patrick. For the 90° lateral flexion, a maximum dynamic value of 33.3 ft-lbs was attained without injury. A preliminary response envelope is proposed based upon the limited data obtained on the volunteers. Further studies are required to investigate the neck injury mechanism for the 45° and 135° lateral flexions, consequently no neck response curves and response envelopes for these modes are given.

by Lawrence M. Patrick; Clifford C. Chou
Biomechanics Res. Center, Wayne State Univ., Detroit, Mich. 48202
Rept. No. VRI-7.3 ; 1976; 184p 23refs
Availability: SAE

HS-018 820

U.S. GOVERNMENT INTERAGENCY COMMERCIAL VEHICLE POST-1980 GOALS STUDY. DRAFT

The purpose of this study was to set motor vehicle fuel economy goals compatible with environmental, safety, and economic objectives. The vehicles concerned were commercial motor vehicles, buses and trucks, with gross vehicle weight ratings of

over 10,000 pounds. The future fleet is shown to meet a 68% increase in demand for freight movement with a 9% increase in the number of vehicles, a 50% increase in vehicle miles traveled and most importantly, with only a 21% increase in total fuel consumption. The composition of the fleet is projected to change dramatically toward diesel power in classes six and seven. Highway speed is projected to remain limited to 55 mph. Highway capacity is projected to increase through 1990 sufficiently to meet the demand without general increases in congestion or degradation of safety. Aspects of commercial vehicle fuel economy are discussed. Optimization of commercial vehicles for fuel economy (under constant operating conditions and unchanged safety and environmental regulations) is expected to produce improvements of the order of 43% in miles per gallon for over-the-road trucks. New, idealized aerodynamic shapes are seen to potentially boost the improvements to above 60%. Assessments are made of engines, drivelines, lubricants, tires, engine accessories, tire weight, aerodynamics, and speed for future fuel economy improvements. In addition, driver training, and loading and dispatching practices are discussed as they affect fuel economy and productivity. Gaseous emissions factors to be considered for the future fleet are discussed, the state of technology to meet stringent standards is outlined, and an assessment of air quality under several possible regulatory scenarios is provided. Emission control of heavy duty vehicles is seen to be attainable both by control of engines to prescribed standards and by reduction in energy consumption resulting from changes in vehicle configuration. Continued development of emission control technology is shown to be a necessary element to meet the ambient air quality standards. Discussions of the technology available to meet various noise regulatory scenarios are provided, as well as summary analyses of the community noise benefits which may be realized. Some historical background on highway safety is provided as a basis for projections into the future and to facilitate assessment of the role played by commercial vehicles in the overall highway safety picture. Potential safety improvements in new vehicles and safety programs directed at in-use vehicles are outlined and discussed. Aggregate effects are projected for the candidate safety programs, as are costs and fuel economy impacts (resulting from increased tire weight). A 20% fatality rate improvement over that of 1973 is projected to stabilize into the 1980's. Factors influencing the operation of fleets and restricting design parameters of vehicles are Federal and State economic and safety regulations, including size and weight limits. Based on FHWA studies, increases in single axle loadings to 26,000 pounds, tandem axle loadings to 44,000 pounds, and gross loads of 120,000 pounds are recommended. The authors' view as to how and when the various recommended futures may come to pass and what the combined effects may be in terms of the costs, configurations and capabilities of representative vehicles (class six local, class eight local, short, and long haul) is presented. In essence, it is expected that most of the fuel economy, safety, environmental, and economic goals previously expressed can be achieved in the 1990 commercial vehicle, but that the vehicle will be heavier and will cost significantly more than its present-day counterpart.

Department of Transportation, Voluntary Truck and Bus Fuel Prog., Washington, D.C. 20590
1976; 371p
Availability: Reference copy only

HUMAN ANATOMY, IMPACT INJURIES AND HUMAN TOLERANCES

A series of articles is presented which are designed to give engineers some knowledge of basic human anatomy, medical terminology, and human tolerances as they relate to impact injuries. A synopsis of anatomy and medical terminology discusses regions of the body, the skeleton, joints, muscles, nervous system, circulatory system, skin, thorax, abdomen, and pelvis, and discusses anatomical problems associated with age; an appendix provides a glossary. The topics dealt with in the article on the anatomy and physiology of the head and neck include the following: bones of the cranium, arteries of the brain, blood supply of the meninges, the orbit and its contents, the nose and nasal cavities, the nasopharynx, sensory nerves of the head and neck, muscles of facial expression, mandible, temporomandibular joint, teeth and occlusion, muscles of mastication, the tongue, salivary glands, mastication and swallowing, blood supply of the neck and facial regions, compartments of the neck, cervical vertebrae, and phonation. The discussion of facial injuries deals with both soft-tissue injuries and with facial bone fractures. The discussions of the musculoskeletal system includes a description of smooth, skeletal and cardiac muscles and of muscle contraction, a description of the bones and cartilage of the body, especially concerning the differences between infants and adults. Fibrous, cartilaginous and synovial joints are also described. Common injuries to the musculoskeletal system are described along with injury causing structures or events, and the injury tolerance and healing capability of the parts of this system. Injuries include bruised, lacerated and torn muscles and tendons, the loss of the blood or nerve supply to muscles, torn ligaments, bone fractures, and laceration of peripheral nerves. Information on thoracic and abdominal anatomy includes discussions of: the lungs and lower respiratory passages, the mediastinum, the heart and pericardium, the abdominal and pelvic walls, the abdominal viscera, and the pelvic viscera. Injuries to the thorax and abdomen are described as chest trauma (closed pneumothorax, open pneumothorax, flail chest, subcutaneous emphysema, hemothorax, and injuries to the diaphragm, heart, aorta or great vessels) and abdominal trauma (injuries to the spleen, liver, kidney, pancreas, stomach and bowel, and bladder and uterus). A discussion of the morphology of the nervous system as related to trauma describes the nervous system as composed of the conducting elements (neurons) of nerve cell fibers and a network of synapses at which a complex information transfer occurs. The central nervous system consists of the brain, the brain stem and the spinal cord and its works with the peripheral nerves. Injuries to this system include concussion and contusion, severing of peripheral nerves, fractures and dislocations of the surrounding bones, penetrating wounds, closed vascular difficulties and long-term sequelae. Human tolerance to impact, methods of testing this tolerance and impact injuries are also discussed.

by Donald F. Huelke, ed.
Society of Automotive Engineers, Inc., 2 Pennsylvania Plaza,
New York, N.Y.
Rept. No. SAE-700195; SAE-P29 ; 1970; 107p 103refs
Availability: SAE

IMPROVING SAFETY AT RAILWAY CROSSINGS

Guidelines for following up tentative conclusions to improve safety at railway crossings in Australia are presented. Because each year about 75 persons are killed at Australia's 10,000 or so railway grade crossings, increased funds are being made available for crossing improvements, which raises questions as to the best use of the funds. The answer involves three aspects: development of a range of warning devices; a procedure for selecting the available device which is best suited to a particular crossing situation; and a procedure for selecting the most useful improvement projects from a range of competing possibilities. This study attempts to provide guidelines for device and project selection accepting the four standard types of protection commonly used at present; warning signs, stop signs, flashing lights and automatic gates. In order to calculate the benefits of improved protection, statistical models for accident prediction were needed. Most previous researchers had relied on multiple regression techniques to derive these models, but it is shown here that accidents are random events which occur with low frequency, and normal distributions should not be used to describe such behavior. Accident distributions are shown to be Poisson in nature, leading to the adoption of the method of maximum likelihood for developing accident prediction models from the South Australia data. Procedures for device selection and priority ranking of projects were developed from standard methods of engineering economic analysis, in particular, the incremental benefit/cost ratio method. In this application the major benefit is calculated in terms of savings in accident costs resulting from improved protection, while the cost is the cost of capital. All benefits and costs are annualized or discounted to a base year. Comments on the applicability of results outside South Australia are included and guidelines for future research presented. Several tentative conclusions are reached. The six-year accident history of a crossing is a poor predictor of its long term performance. This is important because the community cannot afford to wait for long periods before correcting deficient crossings, nor must it allow itself to be unduly influenced by spectacular accidents which may be isolated occurrences of a random process; the installation of improved protective devices will generally result in a reduction in vehicle/train accidents, but requires increased expenditure and may increase the number of accidents of other types. Overall, however, the effect is usually beneficial in both economic and social terms; automatic gates will virtually eliminate vehicle/train accidents; however, the data were not conclusive in this respect due to limited sample size; some 15 vehicle/train and 29 non-train involved accidents could have been prevented in South Australia in 1968 had the warranted improvements been implemented. Extrapolated national figures would be 85 and 163 respectively. For the statistical work, use was made of an extensive data base collected by the Road Traffic Board of South Australia over a six-year period from 1964 to 1969. The data include an almost complete inventory of that state's 1,830 railway crossings with which has been merged the summarized records of all accidents which occurred at the inventoried crossings during the survey period; not all of which involved trains. The appendices provide examples of application to practical selection and priority problems using procedures developed in the study.

Maunsell and Partners Pty. Ltd., Transportation Systems
Group, Melbourne, Vic., Australia
1976; 143p 47refs
Commissioned by Australian Road Safety and Standards
Authority.
Availability: Corporate author

HS-018 830

FIELD EXPERIENCE WITH SMALLER CARS

Starting and warmup performance, emissions, fuel economy, acceleration performance, and frequency of maintenance data were studied for 17 "small" cars of Amoco Oil's 1974-1975 test car fleet. These cars encompassed a broad range of domestic production and also included a car with a diesel engine and a car with a stratified-charge engine. Cold starting and warmup were less of a problem with the 1975 cars than with the 1974's. Gasoline volatility studies with three of the 1974 model cars showed that cold starting and warmup performance was markedly reduced when using fuels with high 10%, 50% and 90% evaporated temperatures. The diesel car could not be started below -9° centigrade (15° fahrenheit) on the road or -18° centigrade (0° fahrenheit) in chassis dynamometer studies, and ability to start was highly correlated with fuel cetane number. These cars, in general, met the prevailing emissions standards at 6440 km and the diesel and stratified-charge engine cards were outstanding in this respect. Although the 1974 and 1975 cars gave similar fuel consumption on a kilometers per liter basis, the heavier 1975's were more efficient on a kilogram-kilometers per liter basis. In this respect, the diesel car was rather poor. Carburetors required frequent servicing, primarily chokes, and two cars required valve guide servicing due to excessive wear.

by C. R. Cree; B. D. Keller; D. S. Gray
Amoco Oil Co.
Rept. No. SAE-760002; 1976; 8p 3refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, Mich., Feb 23-27, 1976.
Availability: SAE

HS-018 831

IMPROVING DRIVER PERFORMANCE. SYNOPSIS OF A RESEARCH COLLOQUIUM, ANN ARBOR, MICHIGAN, JUNE 4-5, 1975

The remarks and conclusions of four discussion groups are presented, covering educational, legal, social, and economic influences on driving habits. They considered the possibility of developing better models for better driving, the question of our ability to predict effects of such models from our present state of knowledge, and what further data and experimental research are required, as well as whether any immediate action can be taken. Education group made recommendations on driver education, licensing, driver improvements, and advanced training. Legal group covered traffic laws, risk identification, enforcement, adjudication, sanctioning, and records. Social group analyzed communications, risk considerations, and lifestyle. Economic group made recommendations on individual driver incentives, accident cost redistribution, and safety agency incentives. Specific recommendations are numerous, but can be summarized by the following themes: identification of current economic factors operable as individual driver incentives; ways to redistribute accident costs as an incentive to safe driving; and revamping of current practices of Federal funding to state and local highway safety agencies in order to produce more effective driver influence and control programs. There are insufficient data in the area of costs of driving, especially the more hidden costs.

Highway Safety Res. Inst., Univ. of Michigan, Ann Arbor, Mich. 48109
Rept. No. UM-HSRI-SA-75-16; 1975; 32p
Sponsored by the Motor Vehicle Manufacturers Assoc.
Availability: Corporate author

HS-018 832

AUSTRALIAN AMBULANCE SERVICES. A SURVEY OF THEIR ORGANISATION, FUNDING, STAFFING, TRAINING AND EQUIPMENT TOGETHER WITH A BRIEF APPRECIATION OF EMERGENCY MEDICAL SERVICES INCLUDING HOSPITAL CASUALTY DEPARTMENTS

The Australian Medical Association set up a committee in 1966 to carry out a national survey of Australia's emergency medical services. The survey was conducted in two phases: regular returns from ambulance services throughout Australia, and questionnaires from some hospitals. The response rate from ambulance service was very good, but from hospitals it was poor. Australian ambulance services are nonprofit public bodies based geographically. Both salaried and volunteer staff is used. Funding is from several sources: governmental, subscription schemes, and transport fees. Staffing policies vary between the States and regions but the report notes a general lack of emphasis on educational levels. Equipment is adequate although there is no uniformity of interior design even for a given vehicle type. More effective radio contact between ambulance and hospital is recommended so that they can more effectively work as a team. Other recommendations deal with organization, financing, recruitment, and equipment. They are aimed at achieving more standardization, professional services, and adequate financing.

by Christopher Bain; J. S. Robertson; K. G. Jamieson
Australian Medical Assoc., Box 20, Glebe, N.S.W., 2037, Australia
1974; 274p 86refs
Includes "Workload from Road Crashes during the year 1971"
by J. S. Robertson, P. J. Korbel, and C. J. Bain.
Availability: Corporate author \$10.00

HS-018 833

BETTER BRAKES FOR TRUCKS IN MOUNTAIN MINING

Conventional service brakes on large mining trucks are not usually adequate for emergencies in mountain mining situations as shown by tests of stopping distance on grades of 8 to 10% under a variety of conditions. A mathematical calculation of the required braking for deceleration on level and downgrade surfaces shows that additional braking power is needed because a component of the truck weight is acting parallel to the road on a downgrade. Additional braking is also needed because the truck often contains excess weight due to accumulated clay and strengthening material and overloading. It is recommended that braking requirements allow for 10% additional weight, that the principal rotating parts of the friction brake rotate at the same speed as the road wheels, and that service brakes be thick enough to sustain five stop sequences under maximum load.

Publ: Automotive Engineering v84 n5 p36-8 (May 1976)
1976
Based on SAE Papers 760430 "Recommended Standards for the Service Brakes on Large Trucks in Mountain Mining Service" by Graham Walker. Presented at the Earth Moving Industry Conference, Peoria, Ill., April 27-28.
Availability: See publication

November 30, 1977

HS-018 838

HS-018 834

REFUELING EMISSIONS CAN BE CONTROLLED

The results of research conducted by testing laboratories to devise ways of reducing refueling emissions are discussed. The results discussed include: systems for minimizing the emissions; test procedures for measuring the emissions at service stations; and regression equations for predicting the amount of the emissions under a wide range of conditions. Two methods of emissions control are being developed for use at service stations: the vapor balance system and the vacuum assist system with secondary recovery. With both systems, two hoses are attached to the fuel dispensing nozzle. One hose carries fuel to the vehicle tank, and the other routes the gasoline vapor back to the underground storage tank. The vapor balance system relies on the fact that as dispensed fuel fills the vehicle tank, the vapor in the tank is displaced and is forced back to the underground tank. The vacuum assist system with secondary recovery was developed to eliminate the problem of vapor volume growth and the possibility of leakage at the car nozzle neck. In this unit, the vapor return line connects to a vacuum pump maintaining a negative pressure in the line at all times. If there is a leak, air is drawn in instead of gasoline vapor escaping. The secondary recovery unit cleanses the vapor vented to the atmosphere of hydrocarbons. Initial cost of the vacuum assist system as well as maintenance and operating costs are much higher than those connected with the vapor balance system. Two methods of testing the performance of vapor recovery systems at service stations have been developed: the baseline test procedure which involves measuring the amount of vapor evolved from a number of vehicles known to be leak free; and the leak rate procedure which was developed at Stanford Research Institute and is performed in two stages. Both methods are carefully explained and illustrated.

Publ: Automotive Engineering v84 n5 p24-9 (May 1976)
1976

Based on SAE Papers 760307 "Experimental Study of Vehicle Refueling Emissions" by A. M. Hochhauser; 760308 "New-tank Fueling Emissions" by J. B. King; and 760309 "Procedures for Testing Vapor Recovery Systems at Service Stations" by E. M. Liston. Presented at SAE Automotive Engineering Congress and Exposition, Detroit, Feb 23-27, 1976(?).

Availability: See publication

HS-018 835

AVOIDING HEAT TREATMENT PROBLEMS

Specification of materials for production of metal products is considered in aspects of manufacturing operations including heat treatment, limits of properties within heat treatment range, and techniques used during heat treatment. Failure cases are cited to illustrate situations where heat treatment procedures, equipment, or temperature ranges altered final properties of materials used. Such failures included mechanical breakdown, specification noncompliance, and performance changes. Sufficient communication between vendor and materials user is recommended to enable the avoidance or correction of problems due to manufacturing processing of raw materials into finished products.

Publ: Automotive Engineering v84 n5 p31-4 (May 1976)
1976

Based on SAE-760411, "Applications of Metallurgical Analysis to Manufacturing Problems," by Edmund J. Klimek, Borg-

Warner Corp., Presented at Earthmoving Conference, Peoria, 27-28 Apr 1976.

Availability: See publication

HS-018 837

SEAT BELTS IN THE OCCUPANT PROTECTION SYSTEM--AN AMERICAN VIEWPOINT

This paper reviews the history of the traffic accident problem in the U.S.A. and the trend towards a national traffic safety effort leading to the establishment of the National Highway Traffic Safety Administration in 1966. Seat belt fitting is required under the Federal Motor Vehicle Safety Standards. The paper looks at methods which have been used to increase seat belt usage. These include educational, financial, legal and "use-inducing" hardware methods. A review of passive restraint systems is also made, specifically, the air cushion alone or in combination with a collapsible steering column.

by P. R. Knaff

National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Res., Washington, D.C.

1976; 15p

Presented at Seat Belt Seminar, Melbourne, Australia, 9-11

Mar 1976, sponsored by Commonwealth Department of Transport. Keynote Address.

Availability: In HS-018 935

HS-018 838

SEAT BELTS IN THE OCCUPANT PROTECTION SYSTEM--THE EUROPEAN POSITION

The development of seat belts and their use in Europe are reviewed. The present legislative situation is discussed, in which the Common Market stands out as the main forum from which significant future standards will come. In Europe thirteen countries, representing the majority of the vehicle population, have enacted legislation for the compulsory use of seat belts. The literature on the evaluation of the effectiveness of seat belts is mentioned briefly because the paucity of such studies is remarkable. There is a trend in Europe away from design rules and towards performance standards, and the likely shape of a future performance standard for seat belts is outlined. A potential conflict between protecting the restrained and the unrestrained occupant is mentioned. Cost-effective criteria are being applied to safety matters increasingly in Europe. Some possible future changes affecting both the acceptability of belts and their crash performance are discussed, and it is concluded that beyond compulsory use laws, changes in occupant protection systems are likely to come relatively slowly, because of an increasing awareness of the complexity of the real world and the cost penalties to be carried in the future.

by E. M. Mackay

University of Birmingham, United Kingdom

1976; 12p 11refs

Presented at Seat Belt Seminar, Melbourne, Australia, 9-11

Mar 1976, sponsored by Commonwealth Department of Transport. Keynote Address.

Availability: In HS-018 935

HS-018 839

SEAT BELT FITTING AND WEARING IN AUSTRALIA

Current developments in the upgrading of Australian Design Rules on seat belt fitting and their anchorages are reviewed. A summary of rules requiring fitting of seat belts and their dates of application for Australia are presented. Legislation for compulsory seat belt usage markedly increased usage rates while voluntary use decreased before legislation. Further research into safety for passengers wearing seat belts is recommended. Tables included describe: Seat Belt Fitting Rates; Seat Belt Wearing Rates and Application of Design Rules by Vehicle Category and Date.

by J. A. McKenzie; P. W. Milne
Commonwealth Dept. of Transport, Melbourne, Australia
Rept. No. Paper-1; 1976; 26p 43refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 840

SEAT BELT WEARER PROBLEMS

Several surveys carried out by the National Roads & Motorists' Association (N.R.M.A.) and other State automobile associations to assess motorists' reaction to seat belts are described. The paper details the results of surveys carried out for the manually adjusted static belts in earlier model vehicles and for the automatic length adjusting and locking belts fitted to 1975 vehicles. The latter survey assesses the comfort factors of Australian Design Rule 4B. The introduction of retractor-type seat belts has brought about a feeling of insecurity in the minds of many motorists which should be reduced in time and as dual sensitive retractor-type seat belts become more common. The results indicate a need for a publicity campaign to educate the public in the safety features, reliability and operation of retractor type seat belts. The N.R.M.A. is considering the publication of articles to reassure motorists of the benefits of retractor type seat belts and to demonstrate the operation of the locking mechanism by way of a display.

by R. G. Cox
National Roads and Motorist's Assoc., Australia
Rept. No. Paper-2; 1976; 24p 7refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 841

AN EVALUATION OF WEARING COMFORT OF SEAT BELT INSTALLATIONS COMPLYING WITH AUSTRALIAN DESIGN RULES 4B, 4C, AND 5B

A preliminary analysis is presented of data obtained in an experiment on the wearing comfort and convenience of use of seat belt installations, complying with Australian Design Rules 4B, 4C, and 5B. Thirty-one installations were tested by 12 subjects (light and heavy males and females of 5th, 50th and 95th percentile height). Subjects rated nine aspects of seat belt use and made critical comments on each installation. The analysis shows that major improvements could be made by installation

of retractor belts in rear seats, reduced maximum allowable retraction force, and by improved specification of Area A in ADR 5B.

by E. R. Hoffman
University of Melbourne, Dept. of Mechanical Engineering, Melbourne, Australia
Rept. No. Paper-3; 1976; 24p 12refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 842

STATE OF THE ART OF SEAT BELTS AND FUTURE TRENDS OF THE AUSTRALIAN SCENE--PART I

The Australian seat belt scene is described from the point of view of the manufacturer. Factors that have influenced current seat belt installations are reviewed, including legislation, performance criteria, and usage criteria. Some possible future trends in Australian seat belt design and installation are discussed, such as improvement in comfort, adjustment capabilities, accessibility, location of apparatus, and use of belts in crowded situations. Current problems are identified involving the emergency locking retractor and the means for eliminating these problems to improve the protection afforded by these devices. Diagrams of installation, types, and problems associated with seat belts are included, and action taken legislatively and at the manufacturers' level to eliminate seat belt installation deficiencies is discussed.

by R. L. A. Youds
Chrysler Australia Ltd.
Rept. No. Paper-4; 1976; 22p
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 843

STATE OF THE ART OF SEAT BELTS IN AUSTRALIA

This paper reviews the history of introduction of seat belts in Australian motor vehicles. Emphasis is placed on the role of the manufacturer. A lap belt was the first restraint system used. This was followed by the shoulder harness, the lap/shoulder harness assembly and the full harness belt. Most current Australian vehicles use the continuous loop lap/shoulder harness belt. Australian government standards for seat belts were adopted, the first being ASE 35. This controlled belt design, bolt size, webbing size and strength. It combined safety with technical and manufacturing capabilities available at the time. Testing of belts was now necessary. Australian seat belt manufacturers joined the Federation of Automotive Products Manufacturers and worked on an advisory panel for seat belt performance. The result was an improved design rule ADR 4. This design rule is very stringently enforced. Improvements made to seat belts since ADR 4 include adjusters, buckles, webbing, retractors, webbing guides, buckle location and accessibility. National Safety Councils together with the police, automobile associations and similar groups joined in a campaign to promote the use of seat belts. They are now installed as part of the original equipment and wearing is compulsory. Future trends should include increasing

November 30, 1977

HS-018 847

the strength of seat belts, lengthening the durability of the components, and use of energy absorbers.

by R. B. Heath
Rainsfords Metal Products Pty. Ltd., Australia
Rept. No. Paper-5; 1976; 14p
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

HS-018 844

SAFETY BELTS IN THE UNITED STATES: RECENT DEVELOPMENT AND FINDINGS

This paper reviews the development of regulations requiring safety belts and use-inducing systems in U.S. vehicles. In the U.S., installation of safety belts was first required in 1961 for new cars sold in Wisconsin, and by 1964 many states had similar legislation. The paper cites the increasingly stringent regulations imposed over succeeding years -- lap and shoulder belts, "warning systems" (seat belt light and buzzer), automatic retractors and the ignition interlock system. The interlock system was designed to prevent the starting of the engine unless the front seat belts were fastened. This system was not well received by the public and this requirement was altered. Included are the results of studies on safety belt system design and characteristics which affect usage with special emphasis on comfort and convenience. Recently developed systems (in Cadillac Seville, VW Rabbit and Chevette, among others) are evaluated. Although design affects wearing rates, usage laws are even more influential. The crash-protective performance of belt systems is discussed and some recent U.S. accident data relevant to seat belt use are cited. Overall effectiveness measures are .309 for unrestrained versus lap belt and .593 for unrestrained versus lap-shoulder belt.

by P. R. Knaff; P. N. Ziegler
National Hwy. Traffic Safety Administration
Rept. No. Paper-6; 1976; 30p 12refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

HS-018 845

RESTRAINT SYSTEMS FOR OCCUPANT PROTECTION

The state of the art for seat belt systems and their dynamic behavior in simulated crashes are described. Australian legislation requires 3-point automatic belts for front seat occupants, and 3-point belts for rear seat outboard seating positions. Most European countries do not specify particular types of seat belts, but some specifications are provided for seat belt materials and automatic belt retractor locking levels. There are also some requirements applying to dynamic seat belt test procedures. The dynamic behavior of restraint systems is shown to be dependent on factors such as vehicular velocity change and deceleration level, materials tolerance, and belt slack in usage of restraint systems by individuals. A dynamic seat belt test with specific injury criteria for evaluation of performance is recommended. Some attention is also given to the contribution of passive restraint systems to comfort, with specific information on the passive system used in the Volkswagen Golf. Comments are made on additional research

required to provide information on the usefulness of force limiters and preloaded belt systems. It is recommended that uniform international standards be developed for seat belt testing.

by U. Seiffert
Volkswagenwerk AG, Germany
Rept. No. Paper-7; 1976; 21p 4refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935
1976; 27p 15refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

HS-018 847

SELECTION OF MATERIALS FOR SEAT BELTS

Results of an investigation into the design and selection of materials used in five seat belt assemblies of Australian and overseas origin are presented. Materials aspects of the design of the various components are appraised and results are given of a range of tests that were carried out to assess strength, durability, and suitability of materials used. Results of the investigations are discussed with regard to design, comparison of performance, and critical appraisal of selection and use of materials in components. Components studied included metallic, fabric, and plastic materials. The general conclusion reached is that all the seat belts studied are well made. However, attention is drawn to several deficiencies in materials design or selection, and suggestions are made for achieving improvements in these areas. The use of plastic materials instead of metals is shown to be advantageous in terms of cost savings, appearance, and comfort, but their mechanical variability is also cited. Following the investigation cited, six recommendations were made regarding the selection of materials for seat belts. Components made from plastic materials should not be used to carry the full force which may be transmitted by the webbing, or to take the full force as may be applied in the emergency retractors. The locking mechanism in the emergency retractors should have an adequate protection against infiltration by fluids; special care should be taken to avoid sharp edges in all metal and plastic parts; all components made from plastic materials should be heat treated at 100° centigrade before assembly in order to achieve dimensional stability through the relief of residual stresses; more attention should be paid to the stitching of the webbing avoiding, if possible, a zig-zag pattern. Another suggestion is that the stitching should be stronger than the webbing itself; It is suggested that heat treatment of the anchor bolts after manufacture is unnecessary providing the basic material has tensile strength above a minimum value.

by Z. H. Stachurski; I. J. Polmear
Monash Univ., Clayton, Vic. 3168, Australia
Rept. No. Paper-9; 1976; 13p
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

HS-018 848

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DESIGN OF SEAT BELTS FOR RELIABILITY

Minimizing seat belt failures through the use of disciplined approach to design, manufacture, and assembly is discussed. One method developed to improve reliability of seat belts at the initial design stage, consisting of identification of and ways to deal with failure modes, is reviewed. A summary is made of environmental, manufacturing, and assembly design limitations which ultimately may affect seat belt performance. Some design improvements made in a current seat belt assembly are discussed to illustrate the design approach to seat belt improvement and to give some idea of the difficulties faced by design engineers seeking increased product reliability. The improvement areas discussed include the emergency locking retractor, manual length adjusters, webbing, tongues, buckles, webbing end tabs, and attaching hardware. Photographs are included.

by Graeme J. Sheahan
Ford Motor Co. of Australia Ltd.
Rept. No. Paper-10; 1976; 28p 1ref
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 849

QUALITY CONTROL IN RESPECT OF SAFETY RELATED AUTOMOTIVE COMPONENTS

Procedures and controls employed by the Quality Control Department of General Motors - Holden's, Ltd. (G.M.H.) in checking and testing of components and systems which are part of a modern motor vehicle are described. Both G.M.H. and vendor source items are processed with regard to reproduction of components on a continuing basis within those specifications contained in plans, level of inspection together with all gauges and facilities capable of checking attributes of components requiring documentation, and records of performance tests. Additional monitoring and tests are outlined for vendor source items, such as facilities evaluation, specific performance tests for specific items (such as crash tests for seat belt performance testing), and communications requirements between the source and supply manufacturers. Particular attention is given to the quality control procedures applying to safety related items requiring documentation as part of compliance with Australian design rule regulations.

by Edward C. Ekstrom
General Motors-Holden's Ltd., Australia
Rept. No. Paper-11; 1976; 8p
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 850

A REVIEW OF SEAT BELT CRASH PERFORMANCE IN THE UNITED KINGDOM

The reported use and effectiveness of seat belts in the United Kingdom is examined. Firstly the data on the crash performance of belts is reviewed. Studies date from the early 1960's, but all have limitations which have left a number of

questions unanswered concerning the actual performance of belts in real collisions. These questions are discussed with particular reference to different types of seat belts. The need for careful investigation of accidents is outlined. Usage rates for retractor and static belts are given for a number of years, and then the limitations of retractor and static belts are discussed in the light of reported field accident experience and seat belt caused injuries. Suggestions are put forward for further investigations of these problems.

by G. M. Mackay
University of Birmingham, United Kingdom
Rept. No. Paper-12; 1976; 14p 21refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 851

SEAT BELT CRASH PERFORMANCE IN AUSTRALIA

A literature summary is presented, describing Australian experience of the crash performance of 3-point combination lap/shoulder harness belts supposedly constructed, fitted and worn in compliance with the laws of Australian States and Territories. Sections of the paper deal respectively with the statistics of belt usage, abdominal injuries associated with belt wearing and head injuries sustained in spite of belt wearing. Details of belt failures and defects are provided. It is concluded that few belts fail to perform as designed, few significant injuries are produced by belts and that further countermeasures should be designed, especially measures to protect the heads of belt wearers. Photographs are included.

by D. C. Herbert; B. A. Vazey; J. M. Henderson
Traffic Accident Res. Unit, Dept. of Motor Transport, N.S.W., Australia
Rept. No. Paper-13; 1976; 33p 49refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 March 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 852

DYNAMIC TESTS WITH ENERGY ABSORBING SEAT BELT RESTRAINTS

Dynamic tests were carried out with shoulder harness seat belts in their conventional configuration, and with energy absorbers developed at the Aeronautical Research Laboratories incorporated in the shoulder strap and seat mounting. The tests were done on the Hyge Crash Simulator at the General Motors Holden's test center near Melbourne. When tested with a sled acceleration of 240 meters per second squared, the forces in the straps of the energy absorbing system were 30% lower than those in the conventional system, and the seat force was approximately 50% lower. The forces in the energy absorbing system at a sled acceleration of 300 meters per second squared were approximately the same as those developed in the conventional system at a sled acceleration of 180 meters per second squared. The "trade off" of reduced

load against increased dummy movement with the energy-absorbing system is indicated.

by S. R. Sarraillhe
Aeronautical Res. Labs., Dept. of Defense, Melbourne, Australia
Rept. No. Paper-15; 1976; 23p 7refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Dept. of Transport.
Availability: In HS-018 935

HS-018 853

EFFECT OF USAGE ON SEAT BELT STRENGTH

A study was undertaken to investigate whether criteria for scrapping seat belts could be developed. Used seat belts and seat belts which had been worn in frontal accidents were collected from four localities in Australia. Subjective and objective measurement evaluations were conducted on a range of belts by the Snowy Mountains Engineering Corporation. All belts were visually inspected. Webbing, anchor fittings, and buckle of each belt was inspected. Ratings were assigned to these three belt elements on the basis of the inspection. A statistical analysis carried out to establish whether subjective evaluations could be used as a measure of seat belt strength indicated that the seat belt static strength could be predicted with limited accuracy from nondestructive measures and ratings. Further testing is recommended to determine whether strength prediction techniques can be refined, so as to form a basis for legislative action. Present test methods are already suitable for use as criteria for recommending scrapping of seat belts to motorists.

by C. C. Chapman; M. H. Cameron
Commonwealth Dept. of Transport, Australia
Rept. No. Paper-16; 1976; 33p 2refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Dept. of Transport.
Availability: In HS-018 935

HS-018 854

CHILD RESTRAINTS--AVAILABILITY AND USE

The availability and use of restraining devices for young vehicle occupants, who are not directly affected by legislation requiring the wearing of seat belts, were measured in a survey undertaken in Melbourne and Canberra, Australia, in December 1975. Only one in four children had available a "child restraint", but the wearing rate among these children was extremely high. When "adult restraints" are considered also, a little more than half the children had available some form of restraint and, overall, one in three of the children observed was wearing some form of restraint. Of the "child restraints" observed, approximately one quarter were "unapproved" devices. The current major problem is one of increasing the availability of restraints for young children; even well publicized legislation will not be effective until availability improves. Tables which illustrate survey results include information concerning the number of vehicles, the total number of passengers and the number of occupants less than eight years of age observed in Melbourne and Canberra; restraint availability for seating positions occupied by children less than eight years of age; child restraints by type and whether SAA approved; and restraint usage by children under the age of eight years in Melbourne and also in Canberra. A

copy of the bill proposed by the Victoria Legislature concerning 1975 laws for child seat restraints is appended.

by I. R. Johnston
Commonwealth Dept. of Transport, Australia
Rept. No. Paper-17; 1976; 20p 7refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Dept. of Transport.
Availability: In HS-018 935

HS-018 855

CHILD RESTRAINT REQUIREMENTS FROM THE VIEWPOINT OF A MOTHER AND A PSYCHOLOGIST

Some problems of current child restraints and various ways of training children to accept restraint in automobiles are reviewed. Problems with current restraints are identified as escapability, discomfort, and child-proof operating mechanisms. Three major points are stressed with regard to training children to accept restraints: training for restraint wearing should begin at birth; parents must be trained to enforce restraint wearing; and no child should be in any part of a moving vehicle without being restrained from possible injury. Educative principles for both children and parents are discussed, with suggestions for implementing the practices of child restraint with success and confidence in results. The key to the problem rests with the parents.

by M. Prior-Hausen
Monash Univ., Australia
Rept. No. Paper-18; 1976; 8p 3refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 856

CHILD RESTRAINT REQUIREMENTS--A MEDICAL VIEWPOINT

The injury experience of children as car occupants is reviewed. They are injured less often and less severely than adults, but have similar injury distribution. There is evidence that restraint systems are effective and are being used more frequently. Restraint designs must take into account the fact that children have large heads, soft bones and unprotected abdominal organs. Restraints approved to Australian Standard E46 appear satisfactory in laboratory tests.

by G. A. Ryan
Monash Univ., Australia
Rept. No. Paper-19; 1976; 9p 13refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11 Mar 1976, sponsored by Commonwealth Department of Transport.
Availability: In HS-018 935

HS-018 857

REVIEW OF CHILD RESTRAINT STANDARDS

The development of the first Australian standard for child restraining devices in passenger cars, AS.E46-1970 is reviewed, and the success of the standard in ensuring that satisfactory restraints were available on the market for chil-

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dren of different age groups is noted. A major revision of AS.E46 was completed in 1975 and a new standard AS.1754 "Child Restraints for Passenger Cars and Derivatives" published. The revision broadened the range of devices available for approval and introduced dynamic tests for forward, sideways and rearward impacts. Criteria for infant restraints were revised to overcome difficulties experienced by manufacturers in meeting the more exacting requirements included in AS.E46. The development of criteria for the current standard was based throughout on extensive research work carried out mainly at the N.S.W. Traffic Accident Research Unit. The standard is more comprehensive than those adopted in U.K., U.S.A. and New Zealand and that recommended by the International Organization for Standardization.

by E. A. Huxtable
N.R.M.A., Australia
Rept. No. Paper-20; 1976; 20p
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

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A COMMONSENSE APPROACH TO CHILD RESTRAINTS

The development of effective, practical, and economical child restraints is considered. Criteria of effectiveness include avoidance of body contact with vehicle interior, avoidance of excessively high head and chest loading during the deceleration phase, and avoidance of stresses imposed by the restraining device in contact with the child. Criteria for practicality include ease of installation of the device, ease of putting the child into it, design and location of buckles and adjusters, child's comfort, and driver's comfort. Factors to consider in testing child restraints are barrier crash, impact sled, vehicle seat vs test seat, use of dummies, and the test set up. Types of currently used child restraints include the following: enclosing restraint up to 9 kg; forward-facing harness with chair from 9 to 19 kg; forward-facing harness without chair from 9 to 38 kg; forward-facing enclosing restraint from 9 to 19 kg; rearward-facing enclosing restraint from 9 to 19 kg; and rearward-facing chair with harness from 9 to 19 kg. New Australian standards are described; most significant is Design Rule No. 34, specifying upper anchorages in the rear seats of passenger cars and derivatives.

by Thomas G. Molnar
Cooldrive Consolidated Industries Pty. Ltd., Australia
Rept. No. Paper-21; 1976; 13p
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

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PERFORMANCE OF CHILD RESTRAINTS IN CRASHES AND IN LABORATORY TESTS

All child restraints available in Australia have been subjected to a program of dynamic crash simulation studies. Devices approved by the Standards Association of Australia have been shown to have a generally good performance, and those not so approved a generally poor one. 139 crashes involving restrained children have been studied in the field. An analysis

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of 57 of the more serious ones is given, involving 65 children in which the restraint system was subjected to significant crash loads or failed in some way. Bucket-type child restraints approved by the Standards Association of Australia have been shown to have a good performance, with the main reason for injury to the child being intrusion of the child's survival space. Unapproved frame-type seats performed very poorly and exposed children to the risk of severe injury. The use of adult seat belts, if firmly adjusted, offered good protection to even small children. Photographs and diagrams of crash damage and restraints are included.

by J. Michael Henderson; D. C. Herbert; B. A. Vazey; J. D. Stott
Department of Motor Transport, N.S.W., Australia
Rept. No. Paper-22; 1976; 49p 23refs
Presented at Seat Belt Seminar, Melbourne, Australia, 9-11
Mar 1976, sponsored by Commonwealth Department of
Transport.
Availability: In HS-018 935

HS-018 864

DEVELOPMENT AND PRELIMINARY TESTING OF A DRIVING HAZARD QUESTIONNAIRE

A questionnaire that assesses hazard perception in automobile drivers was developed. Its items consist of 60 one- or two-sentence descriptions of commonly encountered driving situations, each of which a respondent rates for danger of an accident on a 7-point rating scale. The questionnaire was given to 15 women 30 or more years of age, 15 men 30 or more, 15 women under 30, and 15 men under 30, all of whom were drivers. Results showed that women rated the situations as being more hazardous than the men did, and that the younger group rated them as being more hazardous than the older group did. Some significant correlations between ratings and numbers of self-reported accidents and traffic violations were found. These showed that individuals having had no accidents or violations in the immediately preceding 5 years generally rated the driving situations as being more dangerous than those having had at least one during that time.

by Stanley M. Soliday
Publ: Perceptual and Motor Skill v41 n3 p763-70 (1975)
1975; 2refs
Availability: See publication; Transportation Systems Group,
Midwest Research Institute, Kansas City, Mo. 64110

HS-018 866

ENGINE MASS AIR FLOW METER

A key component of an air-to-fuel ratio control for engines called the engine mass air flow meter is described. The precision engine air input measuring meter is part of a mass air/mass fuel engine control system. It uses both temperature and pressure sensors to normalize incoming air calculations. The vortex shedding principle meter constantly reports at high electronic data rate the mass air inflow to the engine. Characteristics of the composite device are economy, wide range of application, and high accuracy in sensing. Application

the flow meter is being made to improve engine fuel economy and to simplify emissions control.

by Bernard C. Cartmell; Fred L. Zeisler
Ford Motor Co., Detroit, Mich.
Rept. No. SAE-760017; 1976; 8p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

S-018 867

AIR FLOW MEASUREMENT FOR ENGINE CONTROL

Air flow measurement as a means of achieving engine control for improving fuel economy and lowering the emission output is investigated. The relationship between the air/fuel ratio and the emissions resulting is shown, and means of changing this relationship by sensing and controlling engine conditions are discussed. A technique utilizing a nonintrusive method to avoid flow disturbance during measurement is presented, in which an ultrasonic beam is projected across the vortex path. Development testing and application of the technique, and equipment for its implementation are described. It is concluded that electronic correction to convert volumetric air flow measurements into mass flow measurements is preferable to mechanical methods.

by Robert D. Joy
TEC Associates, Inc.
Rept. No. SAE-760018; 1976; 8p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

S-018 868

NEW APPROACH TO FLOWMETERING--SIMPLE MECHANICAL DEVICE ALLOWS USE OF REASONABLY SPECIFIED PRESSURE TRANSDUCER FOR FLOW AND FOR TOTAL VOLUME METERING

Traditional pressure transducer flowmeters are described. The pressure/flow square law problem and its relation to accuracy is described, and a novel solution to the square law accuracy problem is offered. The solution is based on altering the square law relationship between the differential pressure across an orifice and the flow rate through the orifice by means of a variable function. A flexural iris-type orifice can be provided in order to react to dynamic pressure gradients in the flow system. Pressure transducer accuracy is examined, and a technique of improving pressure transducer accuracy in flowmetering is offered. In composite, a new flowmeter design is recommended. The device features dynamic responsiveness through low volumetric displacement in a no-moving-parts system, replacing a sharp edged orifice by a flexural iris orifice.

by Art Zias
National Semiconductor Corp.
Rept. No. SAE-760019; 1976; 14p 10refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 869

SENSITIVITY OF THE ZIRCONIA OXYGEN SENSOR TO TEMPERATURE AND FLOW RATE OF EXHAUST GAS

An approach to meeting statutory automotive exhaust emission levels is described through use of a closed-loop engine control system. The zirconia oxygen sensor utilized in the system provides a feedback signal for stoichiometric air/fuel ratio control. The sensor was developed in response to the need to quantify factors affecting sensor accuracy. Measurements were made of the relative importance of engine exhaust flow and exhaust temperature on the voltage output of the zirconia oxygen sensor. A test engine was run on a dynamometer at fixed speed and load. A special arrangement on the exhaust pipe permitted independent adjustment of exhaust flow and exhaust temperature. Coefficients for the differential changes in sensor voltage due to changes of engine air/fuel ratio, exhaust flow, and exhaust temperature were determined. It is concluded that a second sensor placed downstream of a catalytic converter could compensate for the variant characteristics of the upstream exhaust sensor.

by William J. Fleming
Research Labs., General Motors Corp.
Rept. No. SAE-760020; 1976; 8p 8refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 870

AUTOMOTIVE TURBINE FUEL FLOW TRANSDUCERS

Turbine fuel flow transducers are discussed as a means for meeting the requirements for onboard automotive fuel flow sensors. The requirements investigated in application of the turbine transducers include reliability, interchangeability, wide flow range, low pressure drop, and immunity to erratic flow conditions in conventional automotive fuel supply systems. The transducers described comprise a rotor with a pivot running vertically in glass or sapphire V-jewel bearings, propelled by liquid entering tangentially into a circular chamber, concentric with the rotor. Laboratory test results of the transducers are presented, and it is concluded that the turbine transducer is suitable to meet automotive fuel flow sensor requirements at competitive costs.

by Wilfried Baatz
FloScan Instrument Co., Inc.
Rept. No. SAE-760021; 1976; 9p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 871

NON-LINEAR ANALYSIS OF CAR BODY STRUCTURE

A nonlinear analysis of automobile body structure by the finite element method is presented. Numerical calculations are made for both the roof crush resistance and seat belt anchorage strength of a body structure, and are compared with experimental test results. Dynamic analysis was also made by an incremental method similar to that used for the static case.

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Results calculated for both situations indicate correspondence of analytical results with experimental results.

by Yoshihiro Kajio; Ichiro Hagiwara
Nissan Motor Co., Ltd., Japan
Rept. No. SAE-760022; 1976; 14p 13refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 872

STRUCTURAL REQUIREMENTS IN MATERIAL SUBSTITUTION FOR CAR-WEIGHT REDUCTION

Structural design requirements related to representative, typical structural design criteria and design constraints for a production vehicle are investigated for use when a substitute material is used in an automotive structure. A simplified method is developed for evaluating the desirability of directly substituting materials to reduce the weight of automotive structures. This is done by explicitly relating the change in weight to the corresponding changes in structural characteristics, when a specific mild steel structure is replaced by one differing only in material and gage. By means of this method, material trade-offs can be directly evaluated by engineers and designers early in the design stage. Examples are given for aluminum and high-strength steel as candidate substitutes for mild steel.

by David C. Chang; J. William Justusson
Research Labs., General Motors Corp.
Rept. No. SAE-760023; 1976; 16p 12refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 873

ON THE DIRECTIONALITY OF THE STRENGTH OF SPOT WELD

The strength of spot welds was investigated under various load axes with a new test apparatus. The load axis was changed in the range of 20° to 90°. Under these conditions yielding strength and ultimate strength of the welds are obtained. Results were analyzed using a two dimensional photoelastic method. It is concluded that the maximum strength of a weld is not greatly affected by load axis because the sheet is deformed before fracture. It is also concluded that yielding strength is affected by load axis, as shown with a two dimensional photoelastic test. It is concluded that spot weld strength analysis should be three dimensional rather than two dimensional in order to account for the process of deformation of materials near and involving the weld.

by Seiichi Kaga; Tadakatsu Hotta; Yoshiaki Yamamoto;
Koichi Ogawa
Osaka Inst. of Tech., Japan; Osaka Technical Coll., Japan;
Univ. of Osaka Prefecture, Japan
Rept. No. SAE-760024; 1976; 10p 1ref
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

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HS-018 874

FRONT BRAKE INTERACTIONS WITH HEAVY VEHICLE STEERING AND HANDLING DURING BRAKING

An analytical model is used to demonstrate certain mechanisms by which vehicle handling during braking is influenced by tire characteristics, load transfer during braking, steering system characteristics, brake imbalance, and other factors. The analysis also shows how steer angle deviations arise from braking and lateral forces acting against compliance of the steering linkage, and the influence of caster geometry on these deviations. The HSRI Directional Response Computer Program for predicting longitudinal and directional response behavior of trucks was modified to include effects of a compliant steering system subject to the force and moment inputs of the front tires in order to investigate quantification of characteristics of handling performance of vehicles. Measurement of bias ply truck tire force and moment characteristics for use in the computer simulation showed that tire alignment torque characteristics reverse in direction at high brake levels any may dominate the effect of geometric caster level into the steering system. Studies utilizing the modified program have indicated that no vehicle will stop perfectly straight without driver steering corrections because of steering deviations and that steering reactions fed back to the steering wheel during braking may reverse direction with anti-brake cycling primarily because of the reversal of tire alignment torques. A relationship between these steering reactions and front brake torque level is shown.

by T. D. Gillespie
Ford Motor Co., Detroit, Mich.
Rept. No. SAE-760025; 1976; 19p 21refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 875

COMMERCIAL VALUE BRAKING SIMULATION: PROBLEM OR SOLUTION TO THE VEHICLE MANUFACTURER

One commercial vehicle braking simulation system which appears to adequately model conditions including non-linear and/or transient conditions while functioning as computer tools is discussed. The user's point of view is emphasized where economic restraints operate to control simulation beyond just modeling vehicle performance. The aspects of input definition, verification, confidence in results, and acceptance criteria are considered as they affect the definition of whether the simulation is effective or not. Recommendations are made to lead to a more commercially useful tool. Both factors defined are applicable to other vehicle simulations. It is concluded that user experience feedback is necessary to development of the simulation technique's full potential.

by R. A. Pepoy
International Harvester Co.
Rept. No. SAE-760028; 1976; 10p 10refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

November 30, 1977

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HS-018 876

EFFECTS OF TEST SPEED AND SURFACE CURVATURE ON CORNERING PROPERTIES OF TIRES

The effect of test speed and surface curvature on tire force and moment properties of tires has been investigated with relation to the cornering properties of tires. Lateral force at low slip angles was shown to increase linearly 8-9% for a tenfold increase in test speed. The effect of test speed on tire force and moment properties produced only a small change in predicted steady state vehicle handling, but a significant change in predicted transient vehicle handling. Surface curvature tended to reduce slip and camber generated lateral force and aligning torque, but the effect is complex and no simple flat to curved surface transformation relationship was found. It is concluded that one method of dealing with the test surface curvature effect would be to test on a flat surface. For this experiment the Calspan TIRF Flat Belt data contained an effect not present in similar data taken on other test machines, manifesting itself as a double curvature in the lateral force ratio data.

by Marion G. Pottinger; Kenneth D. Marshall; Gary A. Arnold
B. F. Goodrich Co.
Rept. No. SAE-760029; 1976; 12p 13refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 877

FREQUENCY RESPONSE OF TIRES--SLIP ANGLE AND LATERAL FORCE

Frequency responses of tires with relation to slip angle and lateral force were investigated, comparing behavior under real driving conditions and laboratory measurements. In order to simplify the demonstration, the rest position (the central position of the slip angle) was always held at 0°, so that with small excitation amplitude a linear steady-state lateral force response could be assumed. It is shown that in non steady-state cases the tire forces can not be assigned to the slip parameters as clearly as in steady-state cases. Transient tire behavior, however, starts at such low frequencies of the slip excitation that steady-state tire measurements are insufficient for exact evaluations of driving dynamics. It is concluded that the behavior of a vehicle is strongly influenced by transient tire properties.

by Rudiger Weber; Hans-Georg Persch
Research Center, Porsche AG, Federal Republic of Germany
Rept. No. SAE-760030; 1976; 22p 38refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

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THE MATHEMATICAL CHARACTERISTICS OF STEADY STATE, LOW SLIP ANGLE FORCE AND MOMENT DATA

The effects of tire break-in, roll-to-equilibrium, and mathematical modeling of the tire force and moment data on the evaluation of low slip angle tire lateral force and aligning torque properties are discussed. It is shown that a standardized break-in and testing sequence is critical to valid com-

parisons of tire lateral force and aligning torque data. The tire relaxation length data required in the design of a steady state lateral force and aligning torque test are presented. The third order polynomial model is proven to be the simplest adequate model for determining cornering coefficient and aligning torque coefficient. The cubic model is recommended for testing.

by R. L. Phelps; W. Pelz; M. G. Pottinger; K. D. Marshall
B. F. Goodrich Co.
Rept. No. SAE-760031; 1976; 14p 10refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 879

TIRE TRANSIENT FORCE AND MOMENT RESPONSE TO SIMULTANEOUS VARIATIONS OF SLIP ANGLE AND LOAD

Tire transient force and moment response to simultaneous variations of slip angle and load were investigated in non steady-state tire tests performed on Calspan's Tire Research Facility. At slip angle and load path frequencies of up to 0.2 rad/ft, attenuations of both lateral force and aligning torque are negligibly small. However, both quantities develop considerable lags at low path frequencies and, hence, show appreciable "dynamic" offsets, amounting to about 10% of the maximum steady-state values at 0.05 rad/ft. Actual, double-lane change maneuvers performed on a skid pad with an instrumented full-size passenger car indicated dynamic offsets of plus or minus 90 lb for lateral force and plus or minus 17 ft-lb for aligning torque. These data were reproduced with good accuracy in simulations on the facility in which both load and slip angle were varied simultaneously in accordance with typical time histories recorded in vehicle tests. It is suggested that these large offsets could significantly influence the dynamic response of vehicles.

by D. J. Schuring; I. Gusakov
Calspan Corp.
Contract DOT-HS-4-00923
Rept. No. SAE-760032; 1976; 14p 12refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 880

LATERAL FORCES OF PASSENGER TIRES AND EFFECTS ON VEHICLE RESPONSE DURING DYNAMIC STEERING

An investigation was carried out to provide a basis for judging whether or not dynamic steering adjustments of the tire forces affect vehicle performance significantly, with special consideration for lateral forces of passenger tires and their effects on vehicle response. A differential equation of cornering force adjustment was developed from experimental data. The equation was applied, for a typical radial ply tire, to a crude but sufficient mathematical model of a vehicle. The responses of the vehicle in certain maneuvers differed to some degree when the model was programmed with instantaneously reacting tires or with simulations of actual tires. It is concluded that there are slight and unimportant effects on the path and heading curves of the vehicle due to the delays in build-up cornering

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force. There also appear to be detectable effects that may be important in the sensory information provided to the vehicle driver.

by S. A. Lippmann; K. L. Oblizajek
Uniroyal Tire Co.
Rept. No. SAE-760033; 1976; 20p 18refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 881

PERFORMANCE ASSESSMENT TECHNIQUES FOR COMMERCIAL VEHICLE WHEELS

Testing and evaluation techniques used in assessing suitability of a commercial vehicle wheel for its prescribed duty are described. Some difficulties of legislative tests are outlined, and some desirable test features which are largely neglected in current proposals are suggested. Difficulties seen include the problem in selecting from a wide variety of test methods and specifications currently in use, since legislators are interested in standardizing methods and requirements. If legislation admits too wide a variety of tests it is seen as failing in the duty of setting standards, since it is possible to choose a test according to the performance outcome desired. It is also seen that too limited a range of tests could inhibit optimum design for improved or optimum performance. It is recommended that legislation should be aimed at unified testing with implementation scheduling, provision of a statistical basis to recognize the nature of the fatigue phenomenon with regard to wheel performance, recognition of the need for service factors, and recognition of the limited scope of the present Code of Practice for Wheels - Specification, Performance and Assessment.

by J. D. Mabon; E. Williams; D. B. Woodcock
GKN Sankey Ltd., United Kingdom
Rept. No. SAE-760043; 1976; 12p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 882

TRANSPORTATION ENERGY CONSERVATION AND DEMAND

Energy conservation and demand relative to transportation are discussed in the six separate papers presented in this record. Titles of the papers are: Impact of the Energy Shortage on Travel Patterns and Attitudes; Evaluation of Interaction Between Rural Regional Transportation and Energy Availability; Energy Savings for Work Trips--Analysis of Alternative Commuting Patterns for New Jersey; Gasoline Demand by Owner Characteristics; Gasoline Use by Automobiles; and Totality Indexes for Evaluating Environmental Impacts of Highway Alternatives.

by Joan B. Silberman, ed.
Transportation Res. Board, National Academy of Sciences,
2101 Constitution Ave., N.W., Washington, D.C. 20418
Rept. No. Transportation-Res-Rec-561; 1976; 74p
Includes HS-018 883--HS-018 888.
Availability: Corporate author \$5.00

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HS-018 883

IMPACT OF THE ENERGY SHORTAGE ON TRAVEL PATTERNS AND ATTITUDES

The effect of the energy shortage on transportation patterns and attitudes in the automobile-oriented, suburban Dutch Fork area in Columbia, South Carolina is examined. Data from several nationwide surveys and selected transit operations are also used. The findings from the Dutch Fork area show that the energy shortage did not appreciably reduce (10 to 15%) the amount of automobile travel and did not substantially affect transit patterns or attitudes. Traffic volumes decreased primarily on weekends; there was less decline on weekdays. Travel was reduced by driving slower and limiting social, recreational and shopping trips. Shifts in travel behavior were moderate, although people expressed an interest in public transit. Gasoline supply more than price appears to have greatly affected travel habits, although the effect of price appears to be reflected in the buying of more small cars. In other words, people did not move away from relying on the car but rather adjusted their driving behavior to conserve gasoline. Data from national surveys also show this pattern. Possibly local public transit will not realize appreciable comparative advantage against the automobile on the basis of price. This further emphasizes the inability of transit to serve a substantial ridership. In addition, failures of public transit to capture and hold a greater part of the market during the energy shortage are a product of poor service quality. The one favorable result for public transit is the verbal support given to transit as a method for dealing with the energy shortage. Public transit can benefit from this support by garnering greater governmental resources, although there are still many reservations about the likelihood of converting public support and governmental investment into substantial patronage increases.

by John F. Sacco; Hatim M. Hajj
University of South Carolina, Columbia, S.C.
Publ: HS-018 882, "Transportation Energy Conservation and Demand," Washington, 1976 p1-11
1976; 5refs
Publication sponsored by Com. on Energy Conservation and Transportation Demand. Prepared for presentation at the Annual Meeting of the Transportation Res. Board (54th).
Availability: In HS-018 882

HS-018 884

EVALUATION OF INTERACTION BETWEEN RURAL REGIONAL TRANSPORTATION AND ENERGY AVAILABILITY

The energy crisis of 1973 can be considered an indicator of future problems. The impact on personal and goods mobility alone will have far-reaching consequences, not only in the urban areas but also in the rural regions. In fact, because of the less dense population distribution, rural regions are more sensitive to changes in energy form, cost, and availability. Maintaining the desirability of U.S. rural regions as a place to live is important to the welfare not only of this country but also of other countries of the world who depend on U.S. food exports for their survival. The wholesale abandonment of unproductive railroad lines imposes limitations on the economic viability of bypassed small cities. It creates constraints in the options for electric power generation and distribution system development and will have a dramatic effect on the economics of grain terminal locations and grain transportation. Even the

system for providing heat to isolated farm homes and small towns will be interrelated with transportation forms of the future. Transportation system decisions have far-reaching implications on individual life-styles and the welfare of the nation, and it behooves decision makers to consider these interrelationships.

by Stanley L. Ring; Kenneth A. Brewer; Douglas L. Butler
Civil Engineering and Engineering Res. Inst., Iowa State Univ., Ames, Iowa
Publ: HS-018 882, "Transportation Energy Conservation and Demand," Washington, 1976 p12-22
1976; 3refs

Prepared for presentation at the Annual Meeting of the Transportation Res. Board (54th), and sponsored by Com. on Energy Conservation and Transportation Demand.
Availability: In HS-018 882

HS-018 885

ENERGY SAVINGS FOR WORK TRIPS: ANALYSIS OF ALTERNATIVE COMMUTING PATTERNS FOR NEW JERSEY

An analysis of energy consumption for work trips in New Jersey is presented. Prepared as an aid to the New Jersey Task Force on Energy, it develops a methodology to quantitatively compare alternative transportation policies intended to reduce energy consumption. Data were obtained on work trip distribution, transit patronage, and modal split for each of the 21 counties in New Jersey for 1970. From these data, work trip lengths and automobile and transit occupancy rates were calculated. Based on these as inputs to a model that predicted total work trip energy utilization, the total daily energy consumption was computed for work trips of New Jersey residents. Modal split, energy per vehicle mile (kilometer), and vehicle occupancy rates were then varied to test alternative strategies for reducing energy consumption. In general, the results of this analysis showed that, given current work trip patterns, greater savings in energy could be achieved by using automobiles than by increasing public transit patronage. Specific policy recommendations were then outlined for automobile and public transit planning.

by Jerome M. Lutin
Department of Civil Engineering, Princeton Univ., Princeton, N.J.
Publ: HS-018 882, "Transportation Energy Conservation and Demand," Washington, 1976 p23-36
1976; 8refs

Prepared for presentation at the Annual Meeting of the Transportation Res. Board (54th), and sponsored by Com. on Energy Conservation and Transportation Demand.
Availability: In HS-018 882

HS-018 886

GASOLINE DEMAND BY OWNER CHARACTERISTICS

A preliminary analysis of gasoline demand in New York State by automobile-owner characteristics is reported. It establishes a base-year (1971) average weekly gasoline demand for male and female automobile owners age 16 to 85. This demand is based on vehicle type, percentage distribution in the automobile mix, annual mileage, and fuel economy. The following observations can be made relating owner characteristics based on present gasoline demand and the effects of rationing and

changes in the automobile mix on that demand. Gasoline demand decreases as owner age increases and as annual mileage decreases. Gasoline demand is lower for women than for men because women have a greater preference for smaller, more economical compact and intermediate vehicles, and fuel economy is higher for cars driven by women than for those driven by men. The trend to purchase larger, heavier, more expensive vehicles and a relatively constant rate of gasoline demand are most pronounced in the 21 to 50 age group (the period of increasing family size and financial security). Subcompact and foreign cars are more economical than other vehicles, travel in excess of the average annual mileage for the entire automobile mix, but are present in too small a proportion of the total automobile mix (in 1971) to have a significant impact on the reduction of the gasoline market demand and fuel economy. Based on estimates of future automobile mixes, an increase in the proportions of more economical automobiles to 30% of the automobile mix (with the economies of all other vehicle types remaining the same) would yield a 20% reduction in market gasoline demand. Based on 1971 estimates for gasoline demand, a 10-gal (38-liter) per-week, per-vehicle rationing scheme would most severely impact owners in the 21 to 50 age group. Assuming no reductions in vehicular travel through public conservation efforts, demand would exceed the allotted supply by a ratio of 2 to 1. Given the maximum reduction in vehicular travel, as observed during February 1974, demand would still exceed the allotted supply by a somewhat lower ratio of 1.5 to 1. If the present vehicle distribution were to be equivalent to that expected for 1980, where the percentage of subcompact cars represents 30% of the market distribution, then the ratio of demand to supply would be just slightly greater than 1 to 1.

by Nathan Erlbaum
Planning and Res. Bureau, New York State Dept. of Transportation, Albany, N.Y.
Publ: HS-018 882, "Transportation Energy Conservation and Demand," Washington, 1976 p37-44
1976; 5refs

Prepared for presentation at the Annual Meeting of the Transportation Res. Board (54th), and sponsored by the Com. of Energy Conservation and Transportation Demand.
Availability: In HS-018 882

HS-018 887

GASOLINE USE BY AUTOMOBILES

A survey of some of the recent work on gasoline demand drawing on the literature on automobile demand is presented and suggests the beginning of an integrated theory of gasoline consumption. Aggregate gasoline demand models are reviewed and where available, short-run price elasticities of gasoline are given. Variables, functional forms, and levels of aggregation are indicated. A method of integrating time-series and cross-sectional automobile data and a hypothesis about the prices of services of different sorts of automobiles are discussed. A gasoline demand equation is formulated and estimated with annual national time-series data for the United States. The results are subjected to formal statistical tests and somewhat more subjective tests of economics and common sense. Papers by P. Balestra and M. Nerlove are cited. F. C. Wykoff's vari-

ant investment theory in the study of demand for automobiles is discussed.

by Robert G. McGillivray
Urban Inst., 2100 M St., N.W., Washington, D.C. 20037
Publ: HS-018 882, "Transportation Energy Conservation and Demand," Washington, 1976 p45-56
1976; 19refs

Prepared for presentation at the Annual Meeting of the Transportation Res. Board, and sponsored by the Com. on Energy Conservation and Transportation Demand. Supported by the Office of Systems Integration and Analysis of the Res. Applied to National Needs Prog. of the National Science Foundation.

Availability: In HS-018 882

HS-018 888

TOTALITY INDEXES FOR EVALUATING ENVIRONMENTAL IMPACTS OF HIGHWAY ALTERNATIVES

An account is given of how, by use of a simple linear vector analysis as an objective quantification of environmental impact, an interdisciplinary group responded to the need for evaluating environmental impacts of highway alternatives. The method used is a linear combination of observable or consensus attributes multiplied by a weighting factor giving the relative importance of the particular attribute considered, such as the amount of urban land disturbed, relative safety of a route, and the cost of a route. For each alternative route considered, an impact index was evaluated from the weighted attributes. A mean impact index and a standard deviation were determined by iteration of the impact index for respective routes. The parameters were then used to infer impact differences among various routes. Use of the totality index method was followed by a sequence of planning processes and events that have influenced the entire transportation process in the southeastern U.S., signifying an era of planning which involves consideration of the environment and greater citizen participation in the planning process. The planning events which are discussed are seen as systems ecology, involving an assessment link between science and society, which accounts for both environmental and human needs and results.

by Eugene P. Odum; Gene A. Bramlett; Albert Ike; James R. Champlin; Joseph C. Ziemann; Herman H. Shugart
University of Georgia; University of Virginia; Oak Ridge National Lab., Oak Ridge, Tenn.
Publ: HS-018 882, "Transportation Energy Conservation and Demand," Washington, 1976 p57-67
1976; 8refs

Prepared for presentation at the Annual Meeting of the Transportation Res. Board (54th), and sponsored by Division A Council.

Availability: In HS-018 882

HS-018 889

SULFURIC ACID EMISSIONS FROM LIGHT DUTY VEHICLES

The systems used by the Office of Mobile Source Air Pollution Control of the U.S. Environmental Protection Agency to measure and analyze automotive sulfuric acid emissions are discussed. One such system involves mixing the entire vehicle exhaust with dilution air in a dilution tunnel. Sulfuric acid samples are then collected by passing a small portion of the dilute exhaust through Fluoropore filters. The sulfuric acid

content of the filters is determined by an automated barium chloranilate method. Test results from a number of advanced prototype vehicles including two stratified charge cars, a Dresser carburetor vehicle, three dual catalyst cars, and a three-way catalyst car are also discussed. It is concluded that the controlled condensation/filtration method using a dilution tunnel is a reliable method for sampling of sulfuric acid aerosol mist. The barium chloranilate method for sulfate determination appears to be an accurate method. Tests results show that many advanced emissions control designs appear to be relatively low sulfate emitters, including the stratified charge engine, Dresser, and Gould vehicles. Some of the more conventional engines with oxidation catalysts tend to have high sulphate emissions, especially the air pump vehicles.

by J. H. Somers; R. Lawrence; C. E. Fett; T. M. Baines; R. J. Garbe

Environmental Protection Agency, Washington, D.C.
Rept. No. SAE-760034; 1976; 15p 12refs

Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.

Availability: SAE

HS-018 890

EFFECT OF CATALYST OPERATING HISTORY ON SULFATE EMISSIONS

A chassis-dynamometer study of sulfate formation on a catalyst-equipped automobile under steady-speed and cyclic operating conditions is described, with attention to effects of preconditioning on sulfate emission rates. Sampling for sulfate and SO₂ measurement was from a dilution tube in which the vehicle exhaust gases were diluted 10:1 with filtered air. Total mass, size distribution, and light-scattering properties of the exhaust particulates were also determined. Sulfate emissions increased with decreasing catalyst temperature down to around 500° centigrade, approaching 0.1 g/mi under stabilized conditions at the optimum speed (40 mi/hr). At this speed, sulfate comprised 75-80% of emitted sulfur and around 90% of the fuel sulfur consumed. Conversion closely approached thermodynamic equilibrium limit at the highest temperatures. Sulfur storage was evident at higher and at lower mi/hr conditions, and also in the series of FTP cycles which began after preconditioning. Results concerning acidity, water content, and size distribution of the emitted sulfate aerosol; noble-metal and nitrate emissions; and sampling and analysis methodology all confirm previously published data.

by D. A. Trayser; F. A. Creswick; E. R. Blosser; W. R. Pierson; R. F. Bauer

Battelle Columbus Labs., Columbus, Ohio; Ford Motor Co.; Chrysler Corp.

Rept. No. SAE-760036; 1976; 24p 30refs

Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.

Availability: SAE

HS-018 891

VEHICLE SULFURIC ACID LEVEL CHARACTERIZATION

Sulfate emission data gathered on a series of 2.3L and 400 CID engine vehicles during a test program conducted in 1975 are presented. The data were obtained from production vehicles, with and without catalysts, as well as prototype vehicles equipped with various advanced concept emission control

systems such as lean reactor and prechamber engines, electronic fuel injection, and three-way catalysts. Monolithic and pelleted catalysts, aged 4,000 miles, were tested, with and without thermactor air. A monolithic catalyst, aged 50,000 miles, also was evaluated. Determinations were made of the large variability of the sulfate emission data from various test cycles, and the effect of catalyst preconditioning temperature on initial sulfate test levels was studied. An effect due to the size of the vehicle cooling fan during chassis roll testing also was noted. The 1974 production (nongate) and lean burn prototype (nongate) vehicles convert less than 2% of consumed fuel sulfur to sulfates and are essentially equivalent in this regard. Vehicles with catalysts convert from 1 to 60% of fuel sulfur to sulfates depending on temperature, oxygen in the exhaust gas, prior catalyst history, and test cycles. Preconditioning appeared to have a significant influence on the initial sulfate level of systems with catalyst, especially a pelleted catalyst and thermactor air: initial sulfate levels can vary from 29% to 164% of the stabilized level dependent upon whether the preconditioning is with hot or cold catalyst temperatures.

by David C. Irish; R. J. Stefan
Ford Motor Co.
Rept. No. SAE-760037; 1976; 25p 7refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 892

NON-SULFATE PARTICULATE EMISSIONS FROM CATALYST CARS

An experimental program to measure and characterize exhaust particulate emissions from a vehicle equipped with prototype catalyst systems was carried out. Nine catalysts (four monolithic oxidation catalysts, three pelleted oxidation catalysts, and two oxides of nitrogen (NOx) reduction catalysts) were screened on three test fuels. Fuel variables studied were additive, sulfur, and aromatic levels. Particulate emission rates and size distributions were measured for each catalyst/fuel combination. Analyses for sulfate, carbon, bound water, nine metals, organic nitrogen compounds, and organic sulfur compounds were also carried out. Sulfuric acid aerosol was produced along with increased quantities of metal containing particulates, especially of iron and zinc, when the vehicle was equipped with an oxidation catalyst. The mass median equivalent diameter of oxidation catalyst exhaust particulate decreased relative to the nongate or NOx reduction catalyst cases, because sulfuric acid was the predominant component. The particulate size distribution from a NOx reduction catalyst equipped vehicle was similar to that of an unequipped vehicle. No nitrogen or sulfur containing organic particulate matter was found.

by Morton Beltzer
Exxon Res. and Engineering Co.
Rept. No. SAE-760038; 1976; 14p 11refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 893

SIZE CHARACTERIZATION OF SULFURIC ACID AEROSOL EMISSIONS

During a vehicle dynamometer study of sulfur emissions from an automobile equipped with oxidation catalysts, aerosol size distribution measurements were made. The measurements were taken while the exhaust was rapidly mixed with 10 parts of filtered air in a dilution tube. Results obtained with an electrical aerosol analyzer show that, under these dilution conditions, sulfuric acid aerosols are consistently smaller than 0.3 micrometer in diameter. The distribution of aerosol volume (or mass) is slightly bimodal with maxima near 0.03 and 0.09 micrometer particle diameters. When a light-scattering effect is computed from theory using the observed particle size distributions, good agreement is obtained between theory and measured light scattering. Within a reasonable margin of error, consistency is found between cascade impactor data, nephelometer light-scattering data, electrical analyzer data, and chemical analyses for sulfate. The aerosol size distribution measurements obtained afford data to characterize sulfuric acid aerosols formed in engine exhaust.

by David F. Miller; David A. Trayser; Darrell W. Joseph
Battelle's Columbus Labs., Columbus, Ohio
Rept. No. SAE-760041; 1976; 11p 12refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 894

A COMPREHENSIVE METHOD FOR WHEEL TESTING BY STRESS ANALYSIS

A comprehensive wheel testing method is described which permits reliable service life estimation and gives information for optimum wheel design. Key operation of the method is comparison of data disclosed by stress analysis with the physical properties of the material. Stress analysis is done on a slow-rolling test bench under simulated service loads. The scatter range of the stress is evaluated by calculations of probability. The fatigue strength of the material is determined by fatigue tests applying simulated service load programs on specially developed test specimens. When comparing the stress analysis data with the fatigue properties of the material, a stress efficiency factor is introduced. The method can be applied to other types of wheels than the truck spoke wheel assemblies and components as tested.

by George Krause; Fritz Mahnig
George Fischer Ltd., Switzerland
Rept. No. SAE-760042; 1976; 12p 14refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 895

HIGHWAY VEHICLE RETROFIT EVALUATION. PHASE 1: ANALYSIS AND PRELIMINARY EVALUATION RESULTS. VOL. 1, SECTIONS 1 THROUGH 3. INTERIM REPORT

An analysis and preliminary evaluation of selected used-car and light-truck fuel economy retrofit devices is presented. In particular, information is provided that depicts the per-

formance characteristics of retrofit devices that have been brought to the attention of the Department of Transportation as having the potential to improve automotive fuel economy. The spectrum of devices includes carburetors, acoustic and mechanical atomizers, lean-bleed devices, vapor injectors, fuel modifications, inlet manifolds, drivetrain components, drag reduction techniques, driver aids, cooling fans, valve timing, tuneups, exhaust-related systems, engine oils, oil additives, and filters. Included where possible, are analyses of the general operational principles of a given device and its possible effects on spark ignition engine operation in order to substantiate or explain the available test data.

by M. G. Hinton; J. Meltzer; T. Iura; L. Forrest; A. Burke; R. Kopa; W. Lee; K. Swan; F. Augustine; W. Smalley
Aerospace Corp., Environmental and Urban Div., El Segundo, Calif. 90245
Contract F04701-74-C0075-1
Rept. No. DOT-TSC-OST-75-48.I; 1975; 225p 119refs
Volume 2 of this study is HS-018 896. Rept. for May-Oct 1974.
Availability: NTIS

HS-018 896

**HIGHWAY VEHICLE RETROFIT EVALUATION.
PHASE 1: ANALYSIS AND PRELIMINARY
EVALUATION RESULTS. VOL. 2, SECTIONS 4
THROUGH 13 AND APPENDIX. INTERIM REPORT**

An analysis and preliminary evaluation of selected used-car and light-truck fuel economy retrofit devices is presented. In particular, information is provided that depicts the performance characteristics of retrofit devices that have been brought to the attention of the Department of Transportation as having the potential to improve automotive fuel economy. The spectrum of devices includes carburetors, acoustic and mechanical atomizers, lean-bleed devices, vapor injectors, fuel modifications, inlet manifolds, drivetrain components, drag reduction techniques, driver aids, cooling fans, valve timing, tuneups, exhaust-related systems, engine oils, oil additives, and filters. Included where possible, are analyses of the general operational principles of a given device and its possible effects on spark ignition engine operation in order to substantiate or explain the available test data.

by M. G. Hinton; J. Meltzer; T. Iura; L. Forrest; A. Burke; R. Kopa; W. Lee; K. Swan; F. Augustine; W. Smalley
Aerospace Corp., Environmental and Urban and Div., El Segundo, Calif. 90245
Contract F04701-74-C0075-2
Rept. No. DOT-TSC-OST-75-48.II; 1975; 189p 76refs
Volume 1 of this study is HS-018 895. Rept. for May-Oct 1974.
Availability: NTIS

HS-018 897

**MECHANICAL FAILURE: DEFINITION OF THE
PROBLEM. PROCEEDINGS OF THE MEETING OF
THE MECHANICAL FAILURES PREVENTION
GROUP (20TH), HELD AT THE NATIONAL BUREAU
OF STANDARDS, WASHINGTON, D.C., MAY 8-10,
1974**

Sessions from the 20th Meeting of the Mechanical Failures Prevention Group dealt with aspects of modes of failure, consequences of mechanical failure, and implications of mechanical failure. Papers concerning modes of mechanical failure

discuss topics such as, what can be learned from the examination of service failures, mechanical failure by the processes of corrosion, wear, and fatigue, the current approaches toward prediction of failure by stress corrosion cracking, some aspects of elastohydrodynamics, gear failure mechanisms such as tooth breakage, abrasive and adhesive wear, and surface pitting, bearing damage, the ramifications of failures of antifriction bearings related to aircraft applications, and the use of holographic techniques to inspect stress corrosion cracking. Discussions of several aspects of the consequences of mechanical failures include economic considerations in failure prevention, the economic impact of tribology, safety precautions in nuclear power plants, the expectations of the public with regard to safe transportation and building construction, and human factors considerations in automobile servicing at General Motors dealerships. Implications of mechanical failures are discussed as related to science, engineering, industry, for consumer product safety, and materials.

by T. R. Shives, ed.; W. A. Willard, ed.
Institute for Materials Res., National Bureau of Standards, Washington, D.C. 20234
Rept. No. NBS-SP-423; 1976; 244p
Jointly sponsored by NBS Inst. for Materials Res.; Office of Naval Res.; Consumer Product Safety Commission; Frankford Arsenal; Naval Air Devel. Center; American Society for Mechanical Engineers; Federal Aviation Administration; and Goddard Space Flight Center. Includes HS-018 898-018 900.
Availability: GPO, \$6.10, SD Catalog No. C13.10:423, Stock No. 003-003-01451-6

HS-018 898

**MECHANICAL FAILURES AND PUBLIC
EXPECTATIONS OF SAFE TRANSPORTATION**

An attempt is made to classify the variables of circumstance which seem to govern public expectation and to create a structure in which the degree of freedom from mechanical failure which will be tolerated by the public can be reviewed. The possibility of using this structure for estimating public reaction to failures is discussed. A "Schedule of Concerns" developed in an attempt to classify such observations, is presented which seeks to list major classes of socioeconomic concerns and public values which have been the apparent basis for actions (or inactions) in mechanical failure safety decisions made by technical personnel or others exerting controlling responsibility. The sources for these concerns and values were developed from the field of transportation safety and, in candor, are not limited in derivation to safety problems involving only mechanical failure. The field of transportation safety involves human failures as well as physical failures. Concerns listed and evaluated are: economic efficiency in control of loss to society; concerns for equity and social justice; concerns in estimating public acceptance of change or need for change; and concerns for post-accident judgements of design or failure control decisions. Although, in the interaction between society and technology, it is desired to minimize the incidence of mechanical failure under all conditions, the practical ability to circumscribe and control failures in transportation (for example) varies widely. Depending upon identifiable variables in circumstances, society may effectively require a range of performance between complete freedom from failure and genera

November 30, 1977

HS-018 902

acceptance of repeated failures of a life-threatening nature. Discussion of the paper is included.

by Henry H. Wakeland
National Transportation Safety Board, Washington, D.C.,
20591
Publ: HS-018 897, (NBS-SP-423), "Mechanical Failure--
Definition of the Problem," Gaithersburg, Md., 1976 p153-64
1976; 3refs
Presented at the Meeting of Mechanical Failure Prevention
Group (20th), NBS, Gaithersburg, Md., 8-10 May 1974.
Availability: In HS-018 897

HS-018 899

THE PEOPLE CONSIDERATIONS OF AUTOMOTIVE SERVICE

The presentation covers some of the human-factor considerations in servicing automobiles at General Motors (GM) dealerships. Emphasis is placed on the communication channel between customer and mechanic and possible attendant breakdown that can limit the effectiveness of repairs. Specifically, the repair challenges are described relative to vehicle relation and consumer expectations, the customer item-service writer interface, and technical service information for internal service shop communications. In addition, the presentation covers some recent developments of GM service research which address themselves to the above problems, for example: the service writer check sheet--a vehicle simulator oriented approach to customer order write up; "STAR," computerized reading-comprehension method for use in improving the readability of service manuals used by mechanics; "USDA," Universal Symbol Diagnosis Approach, using graphic symbols in a logic tree format to aid in vehicle system problem diagnosis; and a shop operation management system. Discussion of the paper is included.

by F. J. Uhlig
General Motors Corp., Warren, Mich., 48090
Publ: HS-018 897 (NBS-SP-423), "Mechanical Failure--
Definition of the Problem," Gaithersburg, Md., 1976 p171-8
1976
Presented at the Meeting of Mechanical Failure Prevention
Group (20th), NBS, Gaithersburg, Md., 8-10 May 1974.
Availability: In HS-018 897

HS-018 900

MECHANICAL RELIABILITY. IMPLICATIONS FOR ENGINEERING, MANUFACTURING AND DESIGN

Improved methodologies for predicting component durability and lifetime under real-life conditions, when combined with information on material and structure properties derived under realistic test conditions, can be of great value in developing designs with improved mechanical properties. Likewise, the high volume production rates associated with automotive components involve consideration of material processing and manufacturing factors if the proper levels of mechanical performance are to be achieved. The automobile is a complex assembly of some 15,000 different components in a network of functional subsystems and systems. The definition of the problem of mechanical performance is complicated by the absence of a fixed vehicle performance envelope. Control over use of the vehicle is in the hands of the individual driver. This is substantially different from military and aerospace hardware for which there are specified performance envelopes, and

from many consumer products in which the performance follows a fixed pattern, almost independent of consumer preference. The need for more accurate models of consumer usage to predict automotive mechanical failure is emphasized. Discussion of the paper is included.

by W. Dale Compton
Ford Scientific Res. Lab., Ford Motor Co., Dearborn, Mich.,
48021
Publ: HS-018 897 (NBS-SP-423), Mechanical Failure--
Definition of the Problem, Gaithersburg, Md., 1976 p199-208
1976; 8refs
Presented at the Meeting of Mechanical Failure Prevention
Group (20th), NBS, Gaithersburg, Md., 8-10 May 1974.
Availability: In HS-018 897

HS-018 901

PERCEPTION OF ROAD RULES AND PRIORITIES AT THE INTRODUCTION OF A PRIORITY ROAD PROGRAMME

A questionnaire survey of the understanding of road rules and priorities by a representative sample of the driving population of metropolitan Melbourne, Australia was conducted during the introductory phase of an area-wide shift to a major/minor road system. The survey is part of a before-and-after study of the effects on driver behavior of a rapid transition from a tradition of driver-determined priorities, such as the offside priority rule, to a more systematic application of externally applied priorities, as represented by stop and yield signs and markings. The questionnaire presented a paper and pencil simulation of a series of intersection conflicts and high risk maneuvers that might be faced by a driver engaged in an extended trip on a main road. At each decision point the respondent was asked to select from prepared response alternatives the one that in his judgement best fitted the requirements of the situation. The results obtained from a sample of 1001 licensed drivers showed that there was already a partial appreciation of the changes in methods of determining priorities in intersection conflicts and an increased inclination to accept overtaking opportunities on protected road segments. In addition, there were a few occasions on which confusions in the application of driver-determined priorities were not reduced by the changes in the traffic management system.

by Robert K. McKelvey; William K. Mare; Philippa H. Wisdom
Monash Univ., Human Factors Group, Melbourne, Australia
Rept. No. HFR-1; 1975; 65p 8refs
Supported by Australian Dept. of Transport, and Victorian Road Safety and Traffic Authority.
Availability: Corporate author

HS-018 902

OBSERVANCE OF ROAD RULES AND PRIORITIES AT THE INTRODUCTION OF A PRIORITY ROAD PROGRAMME

In a psychological study, intensive observations via video recording and analysis were made of driver behavior on segments of main roads on radial vs crosstown axes of the road grid in an inner Melbourne, Australia suburb. The roads selected were scheduled for transition to full priority status in the Victorian Government's priority road program (Metcon). Their status during the pre-Metcon period concerned was that of mixed priority roads with isolated controlled intersections.

A profile of driver behavior based on observed patterns of conflict resolution and overtaking events was constructed that will allow comparison with a similar profile obtained during a post-Metcon period. This profile is also compared with a cognitive response profile derived from a questionnaire survey with respect to system parameters such as intersection priority allocations and measures of system confidence. The outcome of this comparison suggests that the driving population is already aware of the applicable principles of priority allocation, although imperfectly, and somewhat inconsistent in behavior when assessed by indices of system compliance and confidence.

by Robert K. McKelvey; Philippa H. Wisdom; William K. Mare; Thomas J. Triggs
Monash Univ., Human Factors Group, Melbourne, Australia
Rept. No. HFR-2; 1976; 87p 12refs
Supported by Australian Dept. of Transport.
Availability: Corporate author

HS-018 903

THE ROAD ACCIDENT SITUATION IN AUSTRALIA IN 1975. ANNUAL REPORT NO. 2

Progress made in improving road safety in Australia from 1972 to 1975 is reviewed and areas in which further action and research are recommended are identified. Since 1970 there has been a decrease in the number of traffic fatalities in Australia in spite of an increase in the number of registered vehicles and a rise in population. Seat belt usage has contributed to this decrease. However, there has not been a decrease in the number of fatalities among pedestrians, cyclists, and motor cyclists. Since 1972, the Australian government has accepted a greater role in road safety by creating the Road Safety and Standards Authority, sponsoring research, creating a central information service and providing financial assistance to the states for improving traffic control. In the future two important new initiatives are recommended: a special program of financial assistance for the implementation and controlled evaluation of comprehensive and coordinated alcohol counter measures; and financial and technical assistance to the states for the establishment of integrated statistical systems. These should incorporate, at a minimum, information on accidents, license holders and motor vehicle registrations. Efforts to encourage seat belt usage and proper child restraint systems, improved road design including an increased use of signs and signals for intersection control and efforts to give pedestrians and cyclists safer areas in which to move, research to develop new approaches to motorcycle safety, improved first-aid for crash victims, studies for improved vehicle design, and a system of no-fault personal injury compensation are also recommended.

by C. L. D. Meares
Expert Group on Rd. Safety, G.P.O. Box 2111S, Melbourne, Vic. 3001, Australia
Rept. No. AR-2; 1975; 180p 299refs
A report to the Australian Minister for Transportation.
Availability: Corporate author

HS-018 904

TESTING OF WHEELS

Different methods of testing wheels for motor vehicles are reviewed. Tests for both serial production and new prototypes are described. Serial production tires are tested with road tests

performed under same operating conditions and under diverse operating conditions, achieving increased stress conditions through elevation of static and/or dynamic load. A drum-type wheel test rig is discussed and illustrated as applicable for testing truck wheels. Other tests performed on both serial production and prototype tires include the disc test, the rim/flange test, and rigidity of stud hole countersinking test. Emphasis in the tests is placed on detecting differences in performance from system point to system point of a wheel, either in production or in prototype.

by Albrecht Luders
Kronprinz AG, Solingen, Federal Republic of Germany
Rept. No. SAE-760044; 1976; 8p
Presented at the Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 905

INJURIES TO CHILDREN IN AUTOMOBILES IN RELATION OF SEATING LOCATION AND RESTRAINT USE

Data based on 26,971 passengers less than 15 years old reported in crashes of 1967 or later model automobiles in the calendar years 1973-1974 are used to derive statements regarding injuries to children in relation to seating location and restraint use. Children least likely to be injured in crashes are restrained and in the back seat; those most likely to be injured are unrestrained and are in the front seat. Unrestrained children in the front right seat have the highest injury rate. More than 90% of the children in the surveyed crashes were found unprotected by restraints--paralleling earlier findings for those in cars in general. Back-seat location reduced the injury rate by 28% among unrestrained children and 18% among restrained children. Use of restraints reduced the injury rate by 39% in the front seat and 31% in back. Among unrestrained children, back-seat location is advantageous for both males and females, for both younger and older children, and in automobiles of various sizes. The advantage of back-seat location is most pronounced in frontal impacts. European laws regarding belt use and seating location, by in effect forbidding restraint use by some children, may increase the likelihood that those children will be injured in crashes. It is recommended that in automobiles without automatic restraints such as air cushions, children be restrained, preferably in the back seat, and that they never travel unrestrained in the front seat.

by Alan F. Williams; Paul Zabor
Insurance Inst. for Hwy. Safety, Watergate 600, Washington, D.C., 20037
1976; 23p 34refs
Data used in the report were obtained from Univ. of North Carolina Hwy. Safety Res. Center.
Availability: Corporate author

HS-018 906

AN EXPERIMENTAL STUDY OF AUTOMOBILE DRIVER CHARACTERISTICS AND CAPABILITIES. FINAL REPORT

An experimental program to obtain quantitative data on how drivers utilize the performance and handling properties of their vehicles has been performed. Over one hundred drivers participated in the experiment, which consisted of self-paced driv-

ing through a specially-constructed proving ground handling course several times. Continuous measurements of primary input variables (steering wheel motions and brake pedal activity) and the principal vehicle responses (speed and lateral and longitudinal accelerations) were made throughout each trial. Total time in the course and incidents of failure to maintain path were also measured. Driving techniques (e.g., hand position on the steering wheel, foot used for braking) of the subjects, who were selected to provide an appropriate representation of the driving population with respect to age, sex, and years of driving experience, were subjectively observed. Experimental results are analyzed primarily in terms of the application of the maneuvering potential of the vehicle (i.e., lateral acceleration) used by the subjects in negotiating the various driving tasks which they encountered in the course. The results are given in terms of mean values and standard deviations for various groupings within the total sample and, in some cases, have been evaluated for the statistical significance of different factors. The data obtained are also used to characterize the average driver. It is particularly interesting to note that the subjects, even when encouraged to drive at their limit of willingness, did not normally attempt to operate near the limiting capabilities of the automobiles.

by R. S. Rice; F. dell'Amico
Calspan Corp., Buffalo, N.Y.
Contract CC-222
Rept. No. ZS-5208-K-1; AD-A020 720; 1974; 189p 1ref
Prepared under contract for General Motors Corp., General Motors Proving Ground, Milford, Mich. 48042.
Availability: NTIS

HS-018 907

ASAP AND THE COURTS. LEARNING FROM EXPERIENCE THE PROBLEMS OF SYSTEM INTERFACE

Judges unwilling to apply only punitive sanctions against drinking drivers can gain insight into the problems and benefits of court-based treatment systems from the experience of the federally funded Alcohol Safety Action Projects (ASAP) located in 35 states. Because of the ASAP's inexperience with the courts, they encountered many difficulties at first, and many judges were cautious or antagonistic. Within a year, however, greater experience and mutual need brought about closer cooperation. Two major systems for referring drinking drivers have now emerged, each with adaptations to local needs. The first is based on individual judicial attention to each case. The second shifts the caseload by various methods from judges to prosecutors and/or pre-sentence and probation personnel. The main factors determining a court system's choice are judicial attitudes, statutes, licensing penalties, and conflicts between various elements of the court system and the legal profession. An ASAP-like agency is useful in providing the courts with information, education, motivation, and management assistance (problem-solving and evaluation).

by G. J. Scrimgeour
Publ: Journal of Drug Issues p248-54 (Summer 1975)
1975; 6refs
Availability: See publication

HS-018 909

CATALOG OF TABULATIONS. 1974 NATIONAL TRANSPORTATION STUDY

In preparing information for the 1974 National Transportation Report, the Department of Transportation developed a data base suitable for storage and retrieval on electronic computers. Numerous tabulations of these data were also produced from this data base. This catalog provides a list of all such tabulations, an indication of the format and types of data contained in each tabulation, and indicates how potential users of the data may obtain copies. The catalog does not contain the actual data, and any numbers appearing in this catalog on the sample pages of tabulations are strictly illustrative. The data base from which these tabulations were made contains information regarding all modes of transportation in which states and localities have a role in operation or finance. The information was submitted by each state, the District of Columbia, Puerto Rico, and American Samoa. It covers three time periods: an inventory (1972), a long-range plan (1990) and an intermediate range program (1980). The information includes physical characteristics of the transportation system in each year, usage of the transportation system, measures of system performance, and side impacts of the system for each of the principal modes of transportation. It also includes the capital costs of implementing the plans for the 18 year period Jan. 1, 1972 to Jan. 1, 1990, and the programs for the 8 year period Jan. 1, 1972 to Jan. 1, 1980, as well as the costs of operating and maintaining the systems in the years 1971, 1979 and 1989. Also included are sources of funds associated with the 8 year programs. For the most part the costs are those incurred by the public sector.

by Robert D. Murphy
Department of Transportation, Office of Transportation Planning Analysis, 400 Seventh St., S.W., Room 9216H, Washington, D.C. 20590
1975; 240p
Availability: Corporate author

HS-018 910

VISUAL DETECTION CAPABILITY OF NORMAL OBSERVERS: A COMPARISON OF THE RESULTS OF VARIOUS INVESTIGATORS

Some results of studies by other investigators concerned with the visual capacity of the human eye and related to the determination of contrast or luminance difference thresholds are reported and compared with a previous study by the National Research Council of Canada. The purpose was to extend the range of data to encompass more visibility situations in experimental roadway detection experiments. These thresholds are especially important in visibility calculations employed in automobile headlight studies. The perception of objects, roadway markings and delineators is accomplished almost entirely by means of brightness differences. Little color vision is involved. An analytic formulation which relates the luminance difference necessary for detection to the background luminance and the target size for a given exposure time is developed to represent an extended data set.

by P. Huculak
National Aeronautical Establishment, National Res. Council Canada, Ottawa, Ont., Canada
Rept. No. LTR-ST-834 ; 1976; 19p 14refs
Availability: Corporate author

HS-018 911

HSL 76-11

HS-018 911

THE CALCULATION OF NIGHT VISIBILITY DISTANCES OF ROADWAY OBJECTS

In studies on automobile headlighting, several elements need to be considered in evaluating target detection under general road conditions during night driving including illumination and glare sources, road and target characteristics, observer characteristics, and the calculations procedure. Illumination and glare sources include driving and opposing headlamps and moonlight. Road and target characteristics include reflectivity of surfaces, lamp height, observer eye height, road curvature, and the distance and orientation of the target. A study of observer characteristics considers the luminance difference required by an observer for detection as a function of target size and adaptation. The calculation procedure must use an accurate description of the visual field of the driver in order to obtain consistent and predictable results.

by P. Huculak
National Aeronautical Establishment, National Res. Council
Canada, Ottawa, Ont., Canada
Rept. No. LTR-ST-723 ; 1976; 12p 15ref
Availability: Corporate author

HS-018 912

STATEWIDE SYSTEM FOR ANALYSIS OF PEDESTRIAN AND BICYCLE ACCIDENTS

An investigation was made into the existing methods of collecting and analyzing data on North Carolina pedestrian and bicycle accidents. Accidents occurring in 1973, 1974 and a sample of those in 1975 were analyzed. In order to improve the analysis of pedestrian and bicycle accidents, the standard accident report form need not be changed, but the person completing the form should be instructed to: indicate violations committed by pedestrians and bicyclists; indicate whether the pedestrian or bicyclist was a licensed driver; estimate the speed of the bicycle; and include data on the number of roadway lanes, whether sidewalks, crosswalks and bikeways were present, and possible contributing factors such as view obstructions or distractions. Research into pedestrian and bicycle accidents could be improved by: bicycle registration in order to estimate the number of bicycles on the road; analysis of bicycle and pedestrian accidents and a consistent method of reporting statistics on them; increased distribution of the statistical pedestrian report; and appointment of a coordinator to gather and disseminate information on pedestrian accidents. Education in pedestrian and bicycle safety, citations for pedestrians and bicyclists who commit violations and are responsible for accidents, improved reporting and investigation of pedestrian and bicycle accidents, and the construction of sidewalks and bikeways are possible countermeasures to prevent these accidents. The need for complete and accurate accident reporting is emphasized. The North Carolina standard accident report form, its bicycle and pedestrian supplement and instructions, and a cover letter of police officers are appended. A statistical pedestrian accident table for 1973, giving numbers and percentages of injuries and fatalities, road characteristics, time of day, day of week, weather, precrash

speed, obstructions, light conditions, and pedestrian action, alcohol involvement, physical condition, sex, and age.

by Elizabeth L. Linder; Catherine B. Mullen; Lindsay I. Griffin
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C.
1975; 99p 4refs
Availability: Corporate author

HS-018 913

ENERGY CONSERVATION IN TRANSPORTATION AND CONSTRUCTION. CONFERENCE REPORT

The increased cost of energy and construction materials since the oil embargo of 1973 has created an urgent need for energy conservation although many people do not recognize this need. Other sources of energy are possible but development of new ideas like solar or geothermal energy or nuclear fusion will take time. We have responded to the energy crisis through reduced speed limits, the design of more energy-efficient vehicles, carpooling and improved traffic management. Public transportation is a productive energy conservation measure and railroad transportation may become even more energy-efficient through improved design and possibly electrification so people must be encouraged to use these methods. Conservation in construction may be achieved by the use of recycled or novel and more energy-efficient materials and through the use of lower temperatures in paving. In addition to continuing these measures, recommendations for short-term conservation measures include education on the reality of the energy crisis and on the energy saving measures that are available, changing construction specifications to encourage energy savings, conversion from petroleum to coal or other fuels whenever possible, curtailing of nonessential activities like right-of-way mowing, and better vehicle maintenance. Long-term measures should include a continued concern for and analysis of energy conservation measures, increased and more efficient use of public transportation, consideration of transportation in land use and development, development of other energy sources including other energy sources for vehicles, sacrificing some of our creature comforts, improved designs for vehicles especially for public transportation, and improved paving materials.

by Herbert W. Busching, Chairman
Federal Hwy. Administration, National Hwy. Inst.,
Washington, D.C. 20590
1976?; 288p
Includes HS-018 914--HS-018 921, and HS-019 967. Conference held 2-5 Dec 1975 in Atlanta, Ga. and co-sponsored by American Road Builders Assoc.; Clemson Univ.; and Georgia Inst. of Tech.
Availability: Department of Transportation, Federal Hwy. Administration, Washington, D.C. 20590

HS-018 914

HIGHWAY TRANSPORTATION'S RESPONSE TO ENERGY CONSERVATION

In the area of petroleum conservation, the Department of Highway Transportation accomplished conservation through the 55 mph speed limit (which saves not only fuel but also lives), encouraging the use and manufacture of smaller and more energy efficient vehicles, encouraging carpooling, and placing an increased emphasis on traffic management. It has also tried to conserve energy other than petroleum by en-

couraging the use of more energy-efficient street lighting, reducing lighting and heating in its own buildings, looking into the use of recycled or more energy efficient highway construction materials, and reducing its use of highway vehicles. These short-term conservation measures are absolutely necessary, but the development of more sources of clean energy, rather than conservation, should be our long-term goal.

by J. R. Coupal, Jr.

Federal Hwy. Administration, Washington, D.C. 20590

Publ: HS-018 913, "Energy Conservation in Transportation and Construction, Conference Report," Washington, D.C. 1976?

p34-40

1976?

Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.

Availability: In HS-018 913

HS-018 915

ENERGY CONSUMPTION OF ALTERNATIVE TRANSPORT MODES

The energy consumption for bus, rail, and automated schedule transit systems were evaluated on both a parametric basis and a systems basis for the Denver Rapid Transit District during 1974 and 1975. The parametric analysis of vehicular energy consumption indicated that there were no substantial differences between the alternative public transportation systems on a passenger mile basis. The conventional rail had the lowest energy consumption, but it was still only 25% less than an extended bus system. The major difference between extended bus service and electrically-powered vehicles, which results in substantial transfer of resources, is the ability to use raw fuel sources other than petroleum for the electrically powered vehicles. The parametric vehicular analysis evaluated the effect of speed, distance between stops, load factor, station stop time, and grade. Speed and distance between stops are the most significant variables on a seat mile basis. The load factor is the most important variable on a passenger basis. Neither grade nor station stop times were of major significance. The total vehicular energy consumption between the various public transportation systems showed substantial variation between systems. These variations were highly dependent on the network and vehicular use of the network as much as being a function of the types of vehicles. The total energy consumption for the public transportation system included that required for fixed facilities as well as the vehicles. These facilities included stations, maintenance facilities, parking, and guideway heating where required. The fixed facilities consumption ranged from 20 to 40% of the direct consumption of the guideway vehicles. The total cost for all of the systems was computed with the result that regional transportation energy costs were reduced by more than \$20 million per year. This was not accomplished through a reduction in total energy consumption since the total energy consumption of the region remained about the same. The cost savings came primarily through a shift from petroleum to coal and nuclear sources through the electrically powered guideway vehicles. There was no significant impact on regional electrical energy supplies due

to the introduction of an electrically powered transportation system. Results of the study are tabulated.

by John M. Smylie

DeLeuw, Cather and Co., 1 Spale Park Bldg., R-4 Room 2112, Redondo Beach, Calif. 90278

Publ: HS-018 913, "Energy Conservation in Transportation and Construction, Conference Report," Washington, D.C., 1976?

p41-78

1976?; 20refs

Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.

Availability: In HS-018 913

HS-018 916

PUBLIC TRANSPORTATION AND ENERGY CONSERVATION

Although it was the Arab oil embargo of 1973-74 that spurred interest in energy conservation, this is an important consideration even without existing or imminent oil embargos. Currently our transportation sector is plagued with a disproportionate reliance on the least efficient fuel consumer, the automobile. Because people do not want to do without the advantages of private automobiles we must work to improve their efficiency, but better use of public transportation provides us with many opportunities for fuel conservation. Energy conservation in the field of public transportation can be achieved by improving the fuel economy of the vehicles, changing the patterns of urban growth into more compact urban centers, and increasing mass transit usage by improving service and reliability, improving the flow of buses by better traffic management, and providing opportunities for transfer between bus and rail systems. The United States Department of Transportation will continue its current conservation programs such as the 55 mph speed limit, the automobile fuel economy improvement program, promoting car/bus/vanpooling, and requiring improved traffic management and transit services as a condition for highway and mass transit funding.

by Douglas R. Campion

Urban Mass Transportation Administration, 1720 Peachtree Rd., N. W., Atlanta, Ga. 30309

Publ: HS-018 913, "Energy Conservation in Transportation and Construction, Conference Report," Washington, D.C. 1976?

p97-101

1976?

Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.

Availability: In HS-018 913

HS-018 917

ENERGY CONSERVATION: VIEWS BY A STATE DEPARTMENT OF TRANSPORTATION

The energy crisis of 1973 and 1974 may have been helpful by warning us to change our present consumption habits, but now many believe that the crisis has passed. However, although we have an abundant supply of energy, considering energy from all types of sources, we may soon be facing critical shortages of petroleum and natural gas due to our inefficient use of energy. In the long term we must develop new energy sources but meanwhile we must try to reduce our consumption. This is especially important in the field of transportation which consumes a quarter of our energy and is almost totally dependent on petroleum. As a provider of transportation facilities and services, the New York Department of Transportation has tried to reduce energy usage by improving public transporta-

tion, including rural public transportation and rail services, encouraging carpooling and improving traffic flow. It should also encourage more efficient urban settlement patterns. As a consumer of energy, the Department has reduced consumption by changing their road paving materials, reducing roadside mowing, and using their maintenance vehicles more efficiently. A change from mercury to sodium lamps for roadside lighting could also save energy. Past transportation plans, which were made with little concern for fuel usage, must be changed and we need more research on the effect of various policies on energy consumption.

by E. Wilson Campbell
New York Dept. of Transportation, 1220 Washington Ave.,
Albany, N. Y. 12232
Publ: HS-018 913, "Energy Conservation in Transportation and
Construction, Conference Report," Washington, D.C. 1976?
p120-31
1976?; 5refs
Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.
Availability: In HS-018 913

HS-018 918

ENERGY CONSERVATION IN TRANSPORTATION-- WHY AND HOW

It is essential for the independence of our foreign policy and for improving our balance of payments that we reduce our dependence on foreign oil. However, when we attempt to establish a comprehensive program for development of domestic energy supplies each type of development is opposed by those who think that is unnecessary because other sources can be developed. Encouraging conservation is difficult because there are few groups to market, distribute and lobby for it, but people should realize that conservation is good from an economic standpoint when the cost of saving fuel is less than the cost of producing that fuel. In the transportation field energy conservation can be accomplished by increasing the efficiency of the transportation vehicles and by increasing the efficiency of the transportation system by increasing load factors through carpooling, vanpooling, and having airplanes run with more of their seats filled, improving operations, reducing the amount of travel through trip consolidation and land use changes, and shifting to more efficient modes of transportation (from private automobiles and airplanes to rail and buses for passengers and from trucks to rail for freight). Urban mass transit improvements can help conserve energy but should be combined with other measures to reduce reliance on the private automobile for maximum impact. We should be willing to make changes to conserve energy in transportation because we are running out of cheap oil and because conservation will increase the efficiency and economic productivity of our transportation system.

by Sydney D. Berwager
Federal Energy Administration, Office of Transportation
Programs, Twelfth and Pennsylvania Ave., Washington, D.C.
20461
Publ: HS-018 913, "Energy Conservation in Transportation and
Construction, Conference Report," Washington, D.C. 1976?
p158-69
1976?
Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.
Availability: In HS-018 913

HS-018 919

THE WORLD ENERGY CRISIS AND ITS EFFECTS ON TRANSPORTATION

Although the oil embargo brought the energy crisis to public attention, many people now think that the problem is merely one of high prices and a poor balance of payments rather than one of lack of petroleum. However, we are depleting our petroleum reserves, and we must look to new sources of energy while we conserve our present resources. The role of transportation, as a large consumer of energy, especially petroleum, is of great importance in energy conservation, and increased use of public transportation rather than private automobiles offers the best chance for short-term conservation. Long-term conservation measures should include the establishment of guidelines for energy efficiency, greater reliance on public transportation, the use of electric power for transportation, reduction of urban sprawl, elimination of redundancy in transportation services, consideration of energy efficiency rather than comfort, convenience, or high performance in the design of individual and public transportation and a greater standardization of equipment. We are challenged to resolve the conflicts between energy conservation and economic recovery or environmental protection, and between the high initial costs of some systems and their ultimate energy-saving features.

by William J. Ronan
American Public Transit Assoc., 110 Seventeenth St., N. W.,
Washington, D.C. 20036
Publ: HS-018 913, "Energy Conservation in Transportation and
Construction, Conference Report," Washington, D.C. 1976?
p195-209
1976?
Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.
Availability: In HS-018 913

HS-018 920

TRANSPORTATION SYSTEM DESIGN

Fuel conservation is related to highway design with respect to travel distance, vertical grades, horizontal curves, and type of road surface. When considering energy conservation in relation to highways, improvements in three areas--the vehicle, the operating procedures and the geometric design elements--are often mentioned. Of these three, improvements in the geometric design elements will have the least effect on energy conservation. There are presently over 3,730,000 miles (6,104,000 km) of roads and streets in this country. With the completion of the Interstate System, there will not be many more miles of highways built. The emphasis has already switched to the maintenance and operations of the existing network. It is in these areas where energy saving improvements can and should be made. Care should be exercised before adopting something as radical as a 55 mph (90 km/hr) design speed. The "energy crisis" should not be permitted to affect existing geometric design standards at least until ongoing planned research is completed. More and more emphasis should be placed on preferential treatment for high occupancy vehicles on the existing highway network. This is one of the easiest ways to conserve energy as well as reduce air pollution and traffic congestion. If it were possible to redesign the entire road system then it would be possible to develop an energy efficient system. However, the system exists. For isolated improvements, it is possible to include energy conservation as a design

sion variable; but usually other factors, such as safety and costs, receive top priority.

by Thomas E. Mulinazzi
University of Maryland, Civil Engineering Dept., College
Park, Md. 20742
Publ: HS-018 913, "Energy Conservation in Transportation and
Construction, Conference Report," Washington, D.C. 1976?
p210-20
1976?; 9refs
Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.
Availability: In HS-018 913

HS-018 921

ENERGY CONSERVATION RELATED TO TRAFFIC OPERATIONS

Because our petroleum supply for the near as well as the distant future will very likely not be sufficient to meet the demand, we need fuel conservation in transportation. Traffic management offers many opportunities for this. Of the highway factors affecting fuel consumption, distance, vertical grade, horizontal curves and roadway surface factors are not primarily correctable by traffic operations, but traffic operations can greatly affect speed, and speed change factors. The 55 mph speed limit is saving about four million gallons of gasoline per day but it would be better to have variations in speed limits that could range from 35 mph to 60 mph depending on the design and use of the highway. The speed 35 mph gives the best fuel conservation. Speeds under 20 mph are very wasteful as are stops and changes in speed. Traffic engineers can improve the function of streets and roads by creating one-way streets and reversible lanes and by using parking prohibitions. Traffic engineering tools which can be used to improve traffic flow at bottlenecks include channelization through the use of islands, parking prohibitions near intersections or loading zones, turning lanes, lane striping, signs and markings to minimize confusion, controlling loading to certain places or times, and proper intersection controls. The creation of progressive traffic movement will also save fuel by minimizing stops and speed changes. Enforcement of the regulations associated with traffic management is necessary to obtain its benefits. Better traffic management is important because it will save fuel. Also it will be readily accepted by motorists, will improve safety, and is practical and complementary to the present system.

by Harold L. Michael
Purdue Univ., West Lafayette, Ind. 47907
Publ: HS-018 913, "Energy Conservation in Transportation and
Construction, Conference Report," Washington, D.C. 1976?
p221-39
1976?; 17refs
Presented at a Conference held 2-5 Dec 1975 in Atlanta, Ga.
Availability: In HS-018 913

HS-018 922

INTERLABORATORY GROOVE DEPTH MEASUREMENTS AND WEAR ESTIMATION

Comparison is made of measurement of tire groove depth and estimation of wear by seven laboratories in the morning and afternoon for two consecutive days. Results show that the several operators in the various laboratories repeated their measurements within acceptable variation. On averages of six measurements by a single operator, a difference of 0.002 in

(0.05 mm) was considered significant. The variability of operators' averages around their laboratory average was the same for all laboratories surveyed except one. However, averages among laboratories were different, which is attributed to small differences in the measuring practice. The precision of wear rate estimates based on the difference of average groove depths before and after a period of wear is estimated. In one common practice, the difference between the two averages is used to provide the estimate. The precision of an estimate of the wear rate may be improved by increasing the length of the wear test between the measurements or by making several determinations of the rate and estimating an average. It is felt that judicious selection of the distance between measurements and the number of measurements will produce an optimum result in terms of precision and economy of testing.

by Akira Kondo; F. D. Brenner
National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
Publ: "Tire Science and Technology" v4 n2 p59-65 (May 1976)
1976; 3refs
Availability: See publication

HS-018 923

DYNAMIC INDOOR TIRE TESTING AND FOURIER TRANSFORM ANALYSIS

Laboratory tire tests for dynamic spring rate and damping, steady state forces and moments, rolling radius, and cornering force transient measurements are described after Fourier transform analysis. Data are given for six tires (radial, bias, and belted bias in B and H sizes) which were tested at 6, 16, 32, and 97 km/h while the slip angle was varied randomly. Since the analytical procedure assumes linearity of the test system, the slip angle was limited to a 0/-2.5° range. Figures are included which show transfer function estimates for radial and belted bias tires at speeds of 6, 16, and 32 km/h in the range of 0.05 to 4.0 Hz. The most striking feature of these tests was seen to be the effect of speed, which was most apparent at speeds under 16 km/h. The cornering response curves dropped exponentially with increasing frequency, with a more rapid drop occurring for decreasing speeds. They dropped consistently more rapidly for radial tires than for the bias and belted bias (which demonstrated nearly identical characteristics throughout this series of tests). At 32 km/h and above, the cornering response functions became nearly flat. The flattening continued with increasing speed, and at 97 km/h the curve was virtually horizontal. The phase lag showed a similar trend, with increasing lag angles for both increasing frequencies and decreasing speeds. Larger phase lags were consistently found for the radial tires at any given speed or frequency. The same effects were observed in the B size tires. The determination of forces and moments at the footprint of a tire running at a slip angle was made to determine vertical load, lateral force, rolling resistance force, and aligning torque of tires tested. Measurement of dynamic spring rate, damping rate, and the effective rolling radius of a tire was made by using an apparatus which simulates the vertical motions of an automobile suspension. The third area of investigation involved computer use both for data gathering and analysis and

HS-018 924

for control of test conditions. Use of the methods in indoor dynamic testing for performance evaluation is recommended.

by P. J. Sekula; G. I. Hall; G. R. Potts; F. S. Conant
Publ: Tire Science and Technology v4 n2 p66-85 (May 1976)
1976; 11refs
Presented at the ASTM Committee F-9 on Tires Symposium
on Indoor Tire Testing, Akron, 12 Nov 1975.
Availability: See publication

HS-018 924

NATURAL FREQUENCIES OF THE BIAS TIRE

The lowest natural frequencies of a bias tire under inflation pressure are deduced by assuming the bias tire as a composite structure of a bias-laminated, toroidal membrane shell and rigorously taking three displacement components into consideration. The point collocation method is used to solve a derived system of differential equations with variable coefficients. It is found that the lowest natural frequencies calculated for two kinds of bias tire agree well with the corresponding experimental results in a wide range of inflation pressures. Results of the approximate analysis show that the influences of the in-plane inertia forces on natural frequency may be considered small, but the influences of in-plane displacements are large, particularly on the natural frequency of the tire under low inflation pressure.

by Masami Hirano; Takashi Akasaka
Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)
1976; 6refs
Availability: See publication

HS-018 925

DYNAMIC RESPONSE OF TIRES

Dynamic response of tires was analyzed in tire tests performed under time-varying inputs on the Calspan Tire Research Facility with a G78-14 belted tire at low speeds and path frequencies up to 6 rad/ft (20 rad/m). Both slip angle and vertical load were varied, either separately and periodically or in combination. The combination simulated actual time histories of slip angle and load measured in road accident avoidance tests. For path frequencies up to 0.2 rad/ft (0.7 rad/m), attenuation of lateral force and aligning torque amplitudes was negligibly small. However, both lagged static values substantially, leading to dynamic offsets in these quantities. The offsets appeared to be the most significant factors for tires.

by D. J. Schuring
Calspan Corp., Buffalo, N. Y. 14221
Publ: Tire Science and Technology v4 n2 p115-45 (May 1976)
Rept. No. DOT-HS-4-00923; 1976; 10refs
A portion of this work was performed under contract.
Availability: See publication

HS-018 926

ROAD SAFETY AND THE LAW. PROCEEDINGS OF A SEMINAR HELD AT SYDNEY, (AUSTRALIA), 2-3 AUGUST 1973

The keynote address discussed the criminological significance of motoring offences. Other papers discussed measures taken

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in Australia to reduce the road toll, the effects of legislation on road safety, the place of traffic offenses in the criminal justice system and the effect of traffic prosecutions on the system, the amount of police time spent on traffic control and the discretions and value judgements that the police must utilize, trends in sentencing including weekend prisons, the four types of sentences available (fines, license suspensions, probation, and imprisonment) and a survey of the attitudes of magistrates and judges, legislation and law enforcement in the United States as compared with Australia, the role of the law and possible directions of law reform in relation to road safety, current sentencing systems and the need for specialized training for sentencers, the role of criminal and judicial statistics in road safety, the sociology of drivers involved in serious accidents, the problem of alcohol, special problems associated with the young driver, and characteristics of probationary license schemes and points demerit systems. Comments on each group of papers are included.

by C. L. D. Meares
Australian Dept. of Transport, Surface Transport Group
1975; 186p 137refs
Includes HS-018 927--HS-018 931. Seminar conducted for the Expert Group on Road Safety.
Availability: Corporate author

HS-018 927

ROAD SAFETY AND THE LAW--AN OVERVIEW

The road transport system involves the road and the related physical environment, the vehicle, and the road user and his social environment. Road crashes should be regarded as failures in the system as a whole rather than in the single components. The legal system is relevant to road safety in the areas of traffic law, regulation of vehicle design, and commercial law action for negligence. Laws relating to the use of seat belts and motorcyclist's crash helmets have had proven safety benefits. The effects of laws allowing the analysis of breath and blood samples are not as clear, but these laws are recommended. It is also recommended that traffic laws throughout Australia be made uniform, that drivers be made aware of the laws, that the discretionary sentencing power of magistrates and the rationale of point-demerit schemes be examined, that enforcement be investigated and adequately described and recorded, that studies be made on the safety benefits of proposed legislation, the relationship between accidents, violations and convictions, the effectiveness of various sanctions, possible decriminalization of some offences and characteristics of traffic offenders, and that no-fault personal injury insurance be considered.

Publ: HS-018 926, "Road Safety and the Law," Canberra, 1973, p12-20
1975; 44refs
Presented at a seminar held in Sydney, Australia, 2-3 Aug 1973.
Availability: In HS-018 926

HS-018 928

TACKLING THE ROAD TOLL

Road accidents are rarely caused by a single factor. The main interacting components are the vehicle, the road environment, the road user and his social environment. A high degree of safety and efficiency in this complex road transport system can only be achieved by a sustained professional approach

The Australian government has attempted to reduce the toll from road accidents through the enactment of laws requiring seat belt usage, crash helmet usage by motorcyclists, by permitting the use of the Breathalyzer, and helping the states make improvements at locations with bad accident records. It is now working on establishing a central information service on road safety and is sponsoring research in many areas including vehicle design, town planning, driver safety education, traffic law, and accident investigation.

by M. M. Summers
Australian Dept. of Transport
Publ: HS-018 926, "Road Safety and the Law," Canberra, 1975
p33-7
Rept. No. Paper-1; 1975
Presented at a seminar held at Sydney, Australia, 2-3 Aug 1973.
Availability: In HS-018 926

HS-018 929

THE ROLE OF POLICE DISCRETION IN TRAFFIC LAW ENFORCEMENT

Although there is very little researched information available on the subjects of the amount and proportion of police time spent in apprehending and prosecuting traffic cases, the effect of different types of deterrents and the criteria that should be used in deciding when to prosecute, there is much speculation, opinion and estimation. A large amount of police time is spent on traffic activities. Fines, perhaps reinforced by a points system, and on-the-spot infringement notices are considered to be relatively effective deterrents. Some feel that the use of warnings is undesirable because of possible corruption, or the possibility that a constant offender could get an indefinite number of warnings. These objections might be overcome if all warnings were submitted to and issued from a central bureau. In spite of the many difficulties involved, police must exercise considerable discretion and make many value judgments in enforcing traffic laws.

by R. P. Roulston
University of Sydney, Australia
Publ: HS-018 926, "Road Safety and the Law," Canberra, 1975
p64-7
Rept. No. Paper-5; 1975
Presented at the seminar held at Sydney, Australia, 2-3 Aug 1973.
Availability: In HS-018 926

HS-018 930

LAW REFORM FOR ROAD SAFETY

The role of the law and possible directions of law reform in relation to road safety are considered. Although there are four factors involved in road safety (the vehicle, the road, the driver, and the environment) the law is relevant, principally, to driver behavior, and it is suggested that there has been serious overuse of criminal law and penalty sanctions against drivers which may well be counterproductive. In the area of civil law, the threat of legal liability is of minimal significance as a deterrent because of third-party insurance. However, civil law does affect the costs of accidents which are increased by the inadequacies of rehabilitation facilities and the high cost in time and money of adversary proceedings. A greater use of self-insurance for accidents with no personal injury is recommended. The reader of the paper stated his disagreement with

the paper's thesis; he feels that the law cannot effectively influence vehicle and road design and the environment.

by P. S. Atiyah; Geoffrey Palmer
Australian National Univ., A.C.T., Australia
Publ: HS-018 926, "Road Safety and the Law". Canberra, 1975
p110-6
Rept. No. Paper-10; 1975; 7refs
Presented at the seminar held at Sydney, Australia, 2-3 Aug 1973, by G. Palmer on behalf of its author, P. S. Atiyah.
Availability: In HS-018 926

HS-018 931

MOTORING VEHICLES: THEIR CRIMINOLOGICAL SIGNIFICANCE

Although there has been a decline in Great Britain in the number of road fatalities for a given number of miles traveled, the number of deaths and serious injuries is still high. Only a small proportion of road deaths is caused by dangerous driving but driving offenses may have contributed to other traffic deaths, and there is a substantial number of serious traffic offenses of many different kinds. Motoring offenders have been found to be younger and more likely to come from the manual working class than the general population (although this may reflect a tendency for these people to be selectively prosecuted) and to be more likely to have been convicted for non-motoring offenses. There may also be some connection between accidents and aggressive behavior or alcohol consumption but these topics need further study. There is also a need for studies to identify the most persistent and dangerous offenders and for studies on means of changing or neutralizing their behavior including possibly decriminalization of less serious traffic offences and the use of positive sentences (like attendance at a drivers school) for traffic offenders.

by Leon Radzinowicz; Roger Hood
University of Cambridge, England
Publ: HS-018 926, "Road Safety and the Law," Canberra, 1975
p21-7
1975
Presented as the keynote address at the seminar held at Sydney, Australia, 2-3 Aug 1973.
Availability: In HS-018 926

HS-018 932

CONCISE DESCRIPTION OF AUTO FUEL ECONOMY AND PERFORMANCE IN RECENT MODEL YEARS

Auto fuel economy and acceleration performance in recent years were studied by statistical and engineering analyses applied to extensive measurements of the two parameters. Fuel economy data are provided by Environmental Protection Agency certification lists for the four years 1973 to 1976. The performance data are track measurements of 0 to 60 mph acceleration times for 1974 and 1975 vehicles, as reported in popular automotive literature. Several relations, supported by engineering analyses, are selected for making least-squares fits to the extensive measurements. The pivotal variables include inertia weight, horsepower, engine displacement, and rear axle ratio, individually and in combinations. Satisfactory fits are made by power factorial forms and the resulting algorithms have standard errors of estimate in the vicinity of 10% for fuel economy and in the range 10 to 15% for acceleration time. Basically similar power factorial forms fit equally well various

data subsets obtained by model year, by driving schedule, by auto vs. truck, by Federal vs. California certification, and by automatic vs. manual transmission. Results are discussed, interpreted, and compared with results from other statistical and engineering analyses. It is concluded that inertia weight has an overwhelming influence on fuel economy: 7.5% to 9.5% fuel economy change per 10% weight change.

by A. C. Malliaris; H. Hsia; H. Gould
Department of Transportation, Washington, D.C.
Rept. No. SAE-760045; 1976; 16p 12refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 933

EFFECT OF EMISSION CONSTRAINTS ON OPTIMUM ENGINE SIZE AND FUEL ECONOMY

A matrix of cars at three different inertia weights and various displacements were tailored to determine the optimum engine size for best fuel economy within emission and driveability constraints. Two emission standards were considered: 1.5 HC/15 CO/2.0 NOx and .41 HC/3.4 CO/2.0 NOx. Results indicate that the engine size for best fuel economy varied with vehicle inertia weight and emission standard. The gains in fuel economy which can be achieved by weight reduction and by performance deterioration may be offset in the future by more severe exhaust emission standards. It is concluded that the selection of the optimum engine size for best fuel economy involves accounting for exhaust emission targets as well as usual vehicle design parameters such as weight, body size, aerodynamic drag, and performance.

by Roy C. Nicholson; George W. Niepoth
General Motors Corp., Engineering Staff
Rept. No. SAE-760046; 1976; 13p 3refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 934

CREDIBILITY OF DIESEL OVER GASOLINE FUEL ECONOMY CLAIMS BY ASSOCIATION

Fuel economy claims for diesel over gasoline fuel are related with various driving cycles (conditions) in order to show how some of the claims can be justified. The experiments also demonstrate how some of the more impressive diesel over gasoline economy claims relate more to real driving conditions than comparisons which are based on Environmental Protection Agency (EPA) and Society of Automotive Engineers (SAE) experimental test cycles. Current EPA and SAE driving cycles are described in their representation of driving habits, requirements, and conditions. Need for improvement is noted regarding low speed, short trips in cold weather, and for inclusion of various small commercial vehicles. Factors identified as economically influential by comparison tests include trip length, cold weather, and user statistics. It is noted that trips of ten miles or less account for 80% of all trips and 50% of automobile fuel consumed, indicating the need for EPA and SAE test cycle revision. The conversion from gasoline to diesel en-

gines is regarded as a natural evolution, as fuel shortage become more critical.

by W. J. Schultz; C. E. Miesiak; A. E. Hamilton; D. E. Larkinson
Perkins Engines Inc.
Rept. No. SAE-760047; 1976; 15p 12refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 935

SEAT BELT SEMINAR. MELBOURNE, (AUSTRALIA) 9-11 MARCH 1976

Papers are presented on the use of seat belts for vehicular occupant protection. The papers concern the following subjects: an American viewpoint of seat belts in the occupant protection system; the European position on seat belts; seat belt wear and fitting in Australia; seat belt wearer problems; an evaluation of wearing comfort of seat belt installations complying with Australian design rules 4B, 4C, and 5B; the state of art of seat belts and future trends on the Australian scene; recent developments and findings on safety belts in the United States; restraint systems for occupant protection; a review of seat belt crash performance in modern Volvo vehicles; selection of materials for seat belts; the design of seat belts for reliability; quality control in respect of safety related automotive components; a review of seat belt crash performance in the United Kingdom and Australia; some dynamic tests of energy absorbing seat belt restraints; the effect of usage on seat belt strength; child restraints, availability and use; child restraint requirements from the viewpoint of a mother and a psychologist; child restraint requirements from a medical viewpoint; a review of child restraint standards; the performance of child restraints in crashes and in laboratory tests.

Australian Dept. of Transport
1976; 502p 237refs
Includes HS-018 837-018 859.
Availability: Corporate author

HS-018 936

GASOLINE CONSUMPTION IN URBAN TRAFFIC

Gasoline consumption in urban traffic was studied by collection of consumption and dynamical variable data as a car was driven normally with low speed urban traffic. It is shown using regression analysis, that the single traffic variable of 16 studied that can best explain fuel consumption per unit distance is the average trip time per unit distance. Regression results are similar for each of four different methods of sampling the speed/time history of the vehicle in traffic. Such fuel consumption data may be collected by the method which is operationally most convenient. The variable, average trip time per unit distance, explained more than 71% of the variance in fuel consumed per unit distance in these experiments. An interpretation of this result is given in terms of engine/vehicle dynamics and the characteristics of urban traffic. Analysis of data for each of four different drivers showed that the fuel consumed per unit distance was determined mainly by r

average trip time per unit distance, essentially independent of the individual driver.

by Leonard Evans; Robert Herman; Tenny N. Lam
General Motors Corp., Res. Labs.
Rept. No. SAE-760048; 1976; 11p 7refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 937

PHOTOMETRIC REQUIREMENTS FOR LONG-RANGE ROAD TRAFFIC LIGHT SIGNALS

Research on photometric requirements for normal urban vehicular traffic light signals is extended to those for long-range signals on high speed roads. The theoretical requirements are compared with the luminous intensities of currently available signal hardware. It is shown that commercially available equipment can currently meet the proposed minimum intensity levels, but further work is necessary to develop a suitable refractor to give a performance margin to cover deterioration in service. Minimum intensities for new, clean, and properly adjusted red signals for visibility distances exceeding 100 meters are proposed. These performance standards may be met by use of a properly designed 300 mm signal using a 150 W/250 V traffic signal lamp or a 200 mm signal using a tungsten/halogen lamp. It is concluded that the use of 100 W 250 V lamps in 300 mm signals is indicated for use only in special, relatively short-range applications.

by F. R. Hulscher
Publ: Australian Road Research v5 n7 p44-52 (May 1975)
1975; 14refs
Availability: See publication

HS-018 938

THE VISIBILITY OF ALPHABETIC AND SYMBOLIC TRAFFIC SIGNS

Paired alphabetic and symbolic displays of selected road traffic sign messages were examined in two complementary experiments in order to determine the visibility of road traffic signs for observers with both normal and reduced vision. Sixteen familiar road sign messages (regulatory and warning) were examined in both forms by observers with visual acuities from normal to as low as 6.21. Threshold legibility distances were calculated using probit analysis for individual signs and groups of signs. Results show that the average 50% threshold legibility distance for symbolic signs is about twice that for alphabetic signs for all levels of visual acuity. Shape coding included on signs apparently does not enhance their legibility among a set of signs. The sign size required for 0.95 probability of correct identification is approximately 1.7 times larger than the size giving 0.50 probability of correct identification, and reduced visual acuity has a predictable effect on legibility distance. Practical sign design for the actual driver population is discussed, and it is concluded that the use of symbolic sign messages and larger alphabetic sign messages is required.

by R. J. Jacobs; A. W. Johnston; B. L. Cole
Publ: Australian Road Research v5 n7 p68-86 (May 1975)
1975; 19refs
Sponsored by the Australian Road Research Board.
Availability: See publication

HS-018 939

EVALUATION OF THE NORTH CAROLINA HABITUAL OFFENDER LAW

Effectiveness of legislation passed by the North Carolina General Assembly to deal with the habitual offender (HO) was evaluated. The state's driver history file was searched to identify drivers who, since inception of HO legislation, had been referred by the Division of Motor Vehicles to court as being eligible for HO status. There were 6,987 such drivers located, representing 0.19% of the total licensed population. Among this group of drivers, 98% were eligible for HO status because of three major violations as contrasted with only 2% because of 12 moving violations. It also appeared that alcohol played a major role in the driving problems of the subjects. Compared to the general driving population, the HO group has a higher proportion of males, nonwhites, middle-aged persons, and persons holding chauffeur licenses. Pending HO cases were examined as controls for comparison with adjudicated HO cases. No significant differences were found for subjects in the two groups. Records indicate that at least 20% of confirmed HOs drove vehicles within one year after HO court action and 35% within the first two years. Examination of prison records of the HO population showed that 37% of the drivers had at least one imprisonment in the eight years preceding the study, with around 80% of them imprisoned for traffic-related crimes. Driving and accident records of the HO population were compared with those of the general driving population. It was found that 67% of the HO population was violation free in the two year period following referral to court, a lower percentage than found in the general driving population. Their lower accident rate compared with the general population may follow lower reporting rates. Some district attorneys who do not process the HO referrals feel that alternative laws provide adequately for control of the offenders. It is concluded that evidence does not show that HO cases processed through the court system show better subsequent driving performance, as indicated by convictions and crashes reported on the driving record, than HO cases not processed through the court system. Results suggest that time and effort being expended on this program might better be redirected to other driver improvement activities. Appendices include the text of the North Carolina HO statute, HO procedures, letter to District Attorneys, driving records for 13 time frames, prison records for 1973 referred HO's, and analysis of prison record variables by HO types.

by Livia K. Li; Patricia F. Waller
Highway Safety Res. Center, Univ. of North Carolina, Chapel Hill, N.C.
Contract DOT-HS-4-00970
1976; 123p 24refs
Availability: Corporate author

HS-018 940

AN EVALUATION OF THE VISUAL SPEED INDICATOR

An evaluation of the visual speed indicator (VSI), an electronic traffic sign which calculates and displays speeds of vehicles which pass it, is reported. The goal of the VSI is to reduce the variability of speeds about the mean speed on a given roadway, especially those speeds in the upper end of distribution. It was hypothesized that such an effect would take place after viewing the operation of the sign and would last for a minimum distance of two miles downstream. To evaluate ef-

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fectiveness of the VSI, an experimental design was developed whereby speed data were continuously collected on cassette (data) tape during four time periods. The roadway chosen for experimentation was a two-lane rural roadway with a volume of approximately 3,000 vehicles per day, with three sites on the road for measurement of effect. In addition to various descriptive statistics gathered, data were analyzed using a multivariate general linear model computer program. Results indicated significant reductions in both mean speed and percentage of traffic speeding at the location of the sign after the sign was activated, when compared with the upstream control location. These effects were dissipated within two miles, and did not carry over to the downstream location. Speed variance increased significantly at the sign location after the sign was activated, and the change at the downstream location was not significant when compared with the upstream control location. Findings concerning speed variance were counter to hypothesized behavior.

by William W. Hunter; Henry L. Bundy; Robert B. Daniel
Highway Safety Res. Center, Univ. of North Carolina, Chapel Hill, N.C.
1976; 91p 19refs
Availability: Corporate author

HS-018 941

MEASURES OF EFFECTIVENESS, RAILROAD-HIGHWAY GRADE CROSSINGS, AND VISIBILITY

Articles are presented concerning railroad grade crossing signals and warnings, measurement and analysis procedures and tools, and visibility studies. The reports are titled: Toward more effective grade-crossing flashing lights; Description and application of a comprehensive planning procedure for urban railroad relocation; Driver performance in countermeasure development at railroad-highway grade crossings; Measures of the sensitivity and effectiveness of the CORQ traffic model; Erratic maneuvers as an interchange-design feedback tool; Luminance and contrast requirements for legibility and visibility of highway signs; Influence of lighting on accident frequency at highway intersections; An evaluation of retroreflective signing materials under the 3-beam head-lamp system; and Field of view directly behind large trucks and buses.

Transportation Res. Board, National Res. Council,
Washington, D.C.
Rept. No. TRR-562; 1976; 113p 102refs
Nine reports prepared for the 54th Annual Meeting of the Transportation Research Board. Includes HS-018 942 through HS-018 947.
Availability: TRB

HS-018 942

TOWARD MORE EFFECTIVE GRADE-CROSSING FLASHING LIGHTS

A discussion of optimal specifications, relevant technology, compatibility with existing systems, and field tests of railroad grade crossing flashing lights is presented. Limitations which have been imposed on equipment and its performance in warning motorists' at crossings relate to power consumption, cost, visibility, and motorists' perception capabilities. Examination of the literature and existing standards has enabled delineation of functional specifications and desirable characteristics of warning systems for use at grade crossings. Significant im-

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provement is possible through the use of xenon flash lamps in standard crossing mountings, in place of or in concert with conventional lights. The short-duration flash of the xenon unit appears to offer a more effective warning, obtainable with little deviation from the basic framework of applicable standards, motorist familiarity, and conventional equipment.

by John B. Hopkins; F. Ross Holmstrom
Transportation Systems Center, Dept. of Transportation,
Cambridge, Mass.; Lowell Technological Inst.
Publ: HS-018 941 (TRR-562), Measures of Effectiveness,
Railroad-Highway Grade Crossings, and Visibility,
Washington, 1976 p1-14
1976; 17refs
Presented at the 54th Annual Meeting, Transportation
Research Board, Washington, 1976.
Availability: In HS-018 941

HS-018 943

DRIVER PERFORMANCE IN COUNTERMEASURE DEVELOPMENT AT RAILROAD-HIGHWAY GRADE CROSSINGS

Findings of a field demonstration study to determine requirements for grade-crossing accident countermeasures are summarized. Information was obtained on driver behavior, knowledge, and attitudes by using the traffic evaluator system, time-lapse photography, and questionnaires. A review of safety-related factors brought to the grade-crossing situation by the driver was made also. It included licensing and education, safety programs, attitudes and habits, and driver/vehicle capabilities and limitations. An extensive analysis of these data suggested countermeasure concepts and determined target populations for countermeasure intervention. A main factor in accident causation is familiarity with the grade crossings, which leads to overconfidence. Males were overrepresented in the group of unsafe drivers. Behavior measures that may be used to discriminate among candidate countermeasures when they are applied in the field evaluation program include the following: whether the driver looked for trains; change in speed over the final 500 ft. before the crossing; distance from the back at which maximum deceleration occurred; and distance at which the stopping capability of the vehicle equaled the distance to the crossing.

by James H. Sanders
BioTechnology, Inc.
Publ: HS-018 941 (TRR-562), Measures of Effectiveness,
Railroad Highway Grade Crossings, and Visibility,
Washington, 1976 p28-37
1976; 2refs
Presented at the 54th Annual Meeting, Transportation
Research Board, Washington, 1976.
Availability: In HS-018 941

HS-018 945

INFLUENCE OF LIGHTING ON ACCIDENT FREQUENCY AT HIGHWAY INTERSECTIONS

Accident frequency for rural at-grade intersections was determined for 3-year periods immediately before and after lighting. Results from 47 intersections revealed a 49% overall reduction in night accidents after lighting. The average night accident rate per million entering vehicles was 1.89 before lighting and 0.91 after lighting, a reduction of 52%. This reduction, when compared with the night accident rate before lighting and the

November 30, 1977

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day accident rate after lighting is found to be statistically significant at the 99% level. Similar data are provided for groups of intersections for channelization, route turns, number of legs, number of lights, and average daily traffic.

by Fred W. Walker; Stephen E. Roberts
Iowa Dept. of Transportation
Publ: HS-018 941 (TRR-562), Measures of Effectiveness, Railroad Highway Grade Crossings, and Visibility, Washington, 1976 p73-8
1976; 4refs
Presented at the 54th Annual Meeting, Transportation Research Board, Washington, 1976.
Availability: In HS-018 941

HS-018 946

AN EVALUATION OF RETROREFLECTIVE SIGNING MATERIALS UNDER THE 3-BEAM HEAD-LAMP SYSTEM

Comparative brightness of contemporary traffic signing materials was measured under both conventional 2-beam and proposed 3-beam headlamp systems. Systematic evaluation led to a general understanding of sign luminances for conventional 2-beam performance for interstate highway system signs. The design experiment was developed to evaluate the relative change in sign luminance should the 3-beam system be standardized. Photometrically selected 2-beam and 3-beam headlamp sets were obtained, installed in standard-size passenger cars, and aligned. Night luminance measurements were made of retroreflective sign materials by using a telephotometer installed at driver eye position. Luminance measurements were taken at 7 distances from the traveled lane on a uniformly graded tangent section of test road. The proposed low beam is not different from the current low beam. The sign luminance under the proposed mid beam is approximately 4 times greater than it is under the low beam. The high beam provides substantially more light, and sign luminance under the proposed high beam is approximately 2 times greater than it is under the current high beam. Proposed 3-beam headlamp systems are found more than satisfactory in illuminating retroreflective signing materials in current use.

by H. L. Woltman; W. P. Youngblood
3M Co.
Publ: HS-018 941 (TTR-562), Measures of Effectiveness, Railroad Highway Grade Crossings, and Visibility, Washington, 1976 p79-92
1976; 18refs
Presented at the 54th Annual Meeting, Transportation Research Board, Washington, 1976. Includes discussion by A. A. Ayad, H. F. L. Pinkney, and A. L. Harrison (National Aeronautical Establishment, Canada) and author's closure.
Availability: In HS-018 941

HS-018 947

LUMINANCE AND CONTRAST REQUIREMENTS FOR LEGIBILITY AND VISIBILITY OF HIGHWAY SIGNS

Laboratory tests and outdoor observations were carried out in order to determine luminance and contrast requirements for legibility and visibility of highway signs. Laboratory tests, conducted in a darkroom, projected 51 series of test signs from color slides against 5 backgrounds simulating rural, suburban, and lighted-city conditions. Luminances ranged from 0.37 to

4.45 ft-L, and legibilities ranged from 20 to 60 ft/in and increased approximately linearly with log luminance. Legibility was impaired when contrast was below 50 to 60%, and was maximum when contrast was between the ratios of 6 and 13 to 1. Optimum stroke width appeared to be narrower for white than for black letter combinations. Color recognition fell below 75% correct at lower luminances except for red. The reverse was true for small targets. Outdoor observations of 12-in reflective letters (2 color combinations) under headlights confirmed the lower contrast limits for legibility and laboratory-corrected trends were similar. Glance legibility as measured by the laboratory procedure apparently requires higher luminance. Results suggest the minimum requirements for both legibility and visibility for highway signs.

by T. W. FORBES; B. B. SAARI; W. H. GREENWOOD; J. G. GOLDBLATT; T. E. HILL
MICHIGAN STATE UNIV.
Publ: HS-018 941 (TRR-562), MEASURES OF EFFECTIVENESS, Railroad, Highway Grade Crossings, and Visibility, Washington, 1976 p59-72
1976; 17refs
Presented at the 54th Annual Meeting, Transportation Research Board, Washington, 1976. Prepared in cooperation with 3M Co.
Availability: In HS-018 941

HS-018 948

THE CHANGING PERSPECTIVES OF HUMAN FACTOR APPLICATIONS TO AUTOMOTIVE DESIGN

A human factors checklist is presented for use by the design engineer to alert the engineer to major areas where troubles for the human operator of a passenger vehicle generally develop. This preliminary checklist has been applied to the design of a pickup truck cab to illustrate its use. Factors considered include average man dimensions and kinetics, spatial relationships, control constraints, seating problems, environment, vibration, vision capability, and maintenance and maintainability. The terms "average" and "percentile" are explained, and sources of human factors data are suggested to find specific information on spatial and operant requirements for adult men and women in relation to vehicular components and environment. Pertinent Federal Motor Vehicle Safety Standards are also identified. It is suggested that good human factors engineering for vehicles would improve public acceptance of the automotive design engineer's product.

by Max H. Alexander; Ruth E. Dewald
Army Tank-Automotive Devel. Center
Rept. No. SAE-760049; 1976; 22p 32refs
Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-018 949

THE IDENTIFICATION AND IMPROVEMENT OF ACCIDENT BLACK SPOTS

A method is described for determining what changes to the road in a given area will be most effective in reducing accidents with available funds. The method involves the use of accident data which can be recorded and summarized with minimum effort. Traffic accident classification and the records required for black spot identification are discussed, and two

methods by which these records can be used to produce a list of the most hazardous locations in a given area are presented. Guidance is offered on the way in which accident records of locations on the list can be summarized and on various aspects notable when inspecting accident sites. Road improvements recommended for the various types of accidents recorded are described, and an estimate is given of the ways these improvements could reduce accidents. Two cost/benefit techniques for determining improvement priorities are described, and some estimates of the costs of accidents and improvements suggested are listed. The need to evaluate safety improvements is emphasized and details given of a method by which the engineer can determine statistically the effect the improvement has had on reducing accidents. An example is given of calculation of the effectiveness of various improvements in a high accident intersection.

by R. J. Brown

National Inst. for Rd. Res., Pretoria, South Africa
Rept. No. Technical-Manual-K21; 1972; 55p 23refs
Summary in Afrikaans.

Availability: South African Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, South Africa

HS-018 950

ASAP AND BEYOND: A FINAL REPORT TO THE COMMUNITY ON THE UTAH ALCOHOL SAFETY ACTION PROGRAM

A report is given on the work accomplished by the Utah Alcohol Safety Action Program (ASAP) from the time of its establishment in 1972 to 1976. The objective of the ASAP was to provide a higher level, more specialized and coordinated attack on the drinking driver problem under Federal guidance and funding. Funds allocated to Utah ASAP were spent for law enforcement, judicial expenses, project management, evaluation, driver license projects, education and rehabilitation, public information and planning, pre-operational planning, and post-operational reporting. Some efforts instituted in the ASAP are continuing without Federal assistance. The impact of the Utah ASAP is assessed positively in terms of arrests for drunk driving, rate of conviction, court programs, juvenile programs, driver education, recidivism rates, and injury/fatality statistics. Utah ASAP is credited as one of the causes of reducing the number and severity of alcohol-related vehicle crashes, injuries, and fatalities during the program period. The Utah ASAP experience indicates that one or more dedicated officers, with specialized training, and provided with their own vehicles, must be detailed specifically to drunk driving prevention duties during prime hours. Special equipment, such as a tape recorder and screen breath tester would be helpful. The officers should receive overtime pay for court appearance if necessary. Special prosecutors were found to be helpful in implementing legal action against drunk driving offenders. "Diversion" programs, with a conditional plea for first offenders who attend an appropriate education or treatment program, were unevenly administered and the results uncertain, although current evaluation has indicated that such programs are valuable for social drinkers rather than for problem drinkers. Presentence investigation of an offender's background and alcoholic involvement, including the Mortimer-Filkins test score (interview and questionnaire), blood alcohol content (BAC) at time of arrest, and prior record, is valuable in categorizing offenders in terms of need for rehabilitation and possibility of success. A profile of the repeat offender has emerged, which future programs should consider:

self-reported heavy drinking, underemployment, marital problems, middle age, overweight, and disproportional percentage of nonwhite persons. Public information and education have made progress in presenting the problem of drunk driving to the public, but more work is needed on youth education, information about alternatives to drunk driving, and motivating people to prevent others from driving while under the influence of alcohol (DUI). TV and radio commercials appear to reach mass audiences most effectively. Driver's license refusal efforts, more complete records and more vigorous legislation, including more punitive laws and harsher enforcement of current laws, have been suggested, with indications from Great Britain and the Scandinavian countries that effective apprehension or risk thereof is more important than severe penalties. Fees and special taxes imposed on convicted DUI offenders to provide educational and rehabilitation programs were not found to be cost-effective in terms of reducing fatal accidents. The passage to lowered drinking age laws has been found to be detrimental to traffic safety and low levels of BAC under conditions such as fatigue or medication (drugs) have been found to aggravate the results of traffic violations.

1976; 35p

Availability: Reference copy only

HS-018 951

FATIGUE IN AUTOMOBILE DRIVERS DUE TO LONG TIME DRIVING

Physiological and psychological responses due to 10 hours driving and 24 hours round the clock driving were gathered from passenger car drivers in order to study the driver's fatigue level. Responses were classified into three groups: fundamental physiological functions with relation to tension, ability, or fatigue; integral functions such as subjective fatigue and central nervous system functions such as selective reaction time. Results indicate that functions of the central nervous system are most important for maintaining driving skills. Biological rhythm was closely associated with energy reserves in individuals.

by Kazuyoshi Yajima; Kenji Ikeda; Masamitsu Oshima; Toru Sugi

Institute of Medical Electronics, Univ. of Tokyo, Japan; Isuzu Motors, Ltd., Japan

Rept. No. SAE-760050; 1976; 10p 7refs

Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.

Availability: SAE

HS-018 954

THE EFFECTS OF NEW-CAR SAFETY REGULATION ON FATALITY RATES

A study on effects of new-car safety regulation on fatality rates shows substantial reductions in occupant fatality rates for cars covered by such regulation. Based on Maryland fatality data during 1972-1975, the study shows that cars sold prior to safety regulations (models prior to 1964) had an average yearly occupant fatality rate of 44 per 100,000 registered cars. Cars with front outboard lap seat belts as standard equipment required by state law (1964 to 1967 models), as well as so crash protection installed in relation to GSA standards maintained in 1967 models, averaged 35 occupant deaths per 100,000 registered cars. Federally-regulated (post-1967) cars had only

deaths per 100,000 registered cars yearly, 23% and 39% less, respectively, than the two prior statistics. Effects of such regulations on pedestrian fatality rates during the same period are not apparent.

by Leon S. Robertson
Insurance Inst. for Hwy. Safety
1976; 17p
Availability: Reference copy only

HS-018 955

A QUICK, INEXPENSIVE DATA COLLECTION TECHNIQUE FOR APPROACH SPEED ANALYSIS (RAILWAY GRADE CROSSINGS)

A study was carried out to analyze the effect on motorists of improving the warning devices at a railway grade crossing, to evaluate suitable parameters to make the analysis, to study accident history and site conditions and relate these to motorist reaction to the system in use and proposed, and to evaluate the data collection system. Data were collected by use of a photographic system employing a variable speed movie camera to spot speeds and driver reaction to grade-crossing warnings at sufficient locations to develop a speed profile of approaching vehicles. Schematic views are given of the site before improvement, and of marker placement and camera set up position. Parameters for effective grade-crossing warning-approach analysis include marker background, environmental conditions, and visual capabilities. For example, use of a white marker near the horizon may cause data reduction; position of the sun or summer growth of vegetation may interfere. The photographic technique is characterized as effective, inexpensive, easily implemented, and providing a superior permanent record. It is recommended for similar data collection studies.

by Eugene R. Russell; Thomas Butcher; Harold L. Michael
Publ: Traffic Engineering v46 n5 p13-7 (May 1976)
1976
Availability: See publication

HS-018 956

CHARACTERISTICS AND SERVICE REQUIREMENTS OF PEDESTRIANS AND PEDESTRIAN FACILITIES

Known characteristics concerning pedestrians and their facilities, and parameters which constitute service requirements or design criteria in relation to those characteristics, have been collected and discussed. System elements considered include human, pathway, environment, interface, and the total travel system. Characteristics of the pedestrian problem are stated in terms of walking speed, movement on stairs, speed/density relationships, sidewalk volume and effective width, arrival processes and queuing, signalized crossings, and mechanical stairs, walks, and ramps. Average pedestrian walking speed is conservatively estimated at 240 fpm for most design purposes. Average stairclimbing speed is 100 fpm; average descending speed is 120 fpm. The restriction of walking speed caused by crowding begins at about a value of 5 sq. ft. per person. As for sidewalks, effective width and not actual width should be considered; width does not significantly affect volume vs density statistics. The two types of arrival processes are termed bulk and intermittent. The two types of queues are termed lineal (ordered) or unordered. As for pedestrian discipline at signalized crossings, one study showed a 9.8% rate of de-individu-

ated behavior, in which one violator functions as a leader for an entire group to cross in violation of the signals. Information has not been found to develop practical capacities of moving walks as compared to rated capacities, but queuing characteristics in advance of the facility usually determine volumes. Service requirements to accommodate the human factors are given in terms of levels of service, design, occupancy limits, and mechanical limitations. A scheme has been developed to evaluate levels of service for walkways (critical pedestrian area occupancy in pedestrian traffic flow is about 5 sq. ft.); stairs (good lighting and visibility, clear queuing areas and offset from mainstream are important characteristics); and for queues (average interperson spacing of 3-31 ft. is the middle level, and within the range of personal comfort). Design of sidewalks, passageways, and ramps should allow for passage of wheelchairs. Stairs should be so designed so as not to impede the prevailing traffic flow. As for arrival processes, little attention has been given to peaking within short periods of the peak hour, e.g., white-collar workers at an office building. For motor stairs and moving walks, a clear queuing space for 98 persons for a 90 fpm, 48 inch wide motor stair at the practical working capacity of the unit is best determined by computer simulation. Turnstile capacity varies according to design and need for fare collection. Actual efficiency of revolving doors is about 50 persons per minute each way, although observed use is about 25 persons per minute. The information provided is recommended for use by designers to facilitate pedestrian traffic.

by Donald S. Berry; Robert L. Bleyl; John J. Fruin; Barnard C. Johnson; Littleton C. MacDorman; Francis P. D. Navin; Steven C. Provost; James E. Watt, Jr.; Frederick J. Wegmann; Edmund J. Cantilli
Publ: Traffic Engineering v46 n5 p34-45 (May 1976)
1976; 44refs
Prepared with the aid of material from "Pedestrian Planning and Design," By John J. Fruin.
Availability: See publication

HS-018 957

MAINTAINING A LOW PROFILE (IN TIRES)

History and state of the art in automobile tires are reviewed. Tire markings used to explain the type of tire and its approximate speed rating. Tire types discussed include cross-ply, radial, winter cross-ply, and winter radial. Speed limits assigned to each tire type considered are listed according to diameter of tires. Application of tire surface to the road is illustrated in a discussion of cornering effect. Remolded or retreaded tires, reggraded quality D.A., and substandard V Max tires are also considered. Advice is given to automobile owners on the proper selection and use of the various types and ratings of tires.

by Andrew Shanks
Publ: Autocar, p66-8 (24 April 1976)
1976; 3p 1ref
Availability: See publication

HS-018 958

EFFECT OF SPEED LIMITS ON ROUTE SELECTION AND OPINIONS OF MOTORISTS ON SPEED LIMIT REGULATIONS

A survey was made to clarify motorists' opinions on various speed limits for road traffic and on the effect of such limits on

route selection. Interviews were conducted with 1,139 private car operators soon after institution of speed limits on individual roads. Most operators (60%) responded to route selection questions in terms of shortness and economy, and a smaller number cited causes such as safety, scenery, variety, and intermediate stop sites. Eighty-two motorists interviewed implied that they had made a change in route because of speed limits. Factors influencing route were assessed, including age of driver, driving experience, purpose of trip, frequency of drives, length of distance and time of travel, and car size. Approximately half of the respondents considered present limits on individual roads as appropriate and 42% of the motorists considered them too low. It is concluded that the same factors which influence an increase in route change also increase a negative attitude toward speed limits in general.

by Mikko Korkea-aho; Jorma Kettunen
Research Div., LIKENNETURVA, Iso Roobertinkatu 20,
Helsinki 12, Finland
Rept. No. LS-55326; 1974; 52p 5refs
Text also in Finnish.
Availability: Reference copy only

HS-019 944

ERRATIC MANEUVERS AS AN INTERCHANGE- DESIGN FEEDBACK TOOL

A driver-behavior analysis was conducted at a freeway-to-freeway interchange in Council Bluffs, Iowa, to observe erratic maneuvers of the drivers as an interchange design feedback tool. Driver behavior was recorded using videotape equipment, and analysis of the behavior for indications of design problems and alternative solutions was made. For example, the fundamental problem of improper lane placement of through-traffic vehicles could be resolved by lane designations. Deviation from behavior assumed appropriate for established design criteria and forms at the interchange was evaluated for severity, magnitude, frequency, and expected trend over time. The concept of iterative design is demonstrated in the project, and recommended for the quality of dynamism which it injects into potentially dangerous situations.

by Kenneth A. Brewer; Stanley L. Ring
Iowa State Univ., Engineering Res. Inst.
Publ: HS-018 941 (TRR-562), Measures of Effectiveness,
Railroad Highway Grade Crossings, and Visibility,
Washington, 1976 p49-58
1976; 20refs
Presented at the 54th Annual Meeting, Transportation
Research Board, Washington, 1976.
Availability: In HS-018 941

HS-801 191

IDENTIFICATION ET CORRECTION DES ZONES DANGEREUSES DE LA ROUTE (IDENTIFICATION AND CORRECTION OF ROAD HAZARDS PROJECT)

A questionnaire was designed and administered to road users and road user administrators to identify road hazards, to suggest ways of eliminating such hazards, to evaluate the efficacy of the study, and to gather various comments pertaining to the road hazard problem. After seminar study of questionnaire responses, recommendations were made pertaining to the use of accident reports to identify road hazards, detection of road hazards through systematic study and review of transportation

routes in use, and a continual program of road improvement correlated with hazard identification. Remedial study and correction programs for local and national application are suggested. Results of study and improvement programs should be factored into future design processes to eliminate the production of future road hazards.

Committee on the Challenges of Modern Society
Rept. No. CCMS-25; 1974; 29p
Text in French.
Availability: NHTSA

HS-801 703

EXPERIMENTAL SAFETY VEHICLE PROGRAM AND VEHICLE SAFETY RESEARCH PROGRESS REPORT, JANUARY-JUNE 1975

The activities of the Experimental Safety Vehicle Program and Vehicle Safety Research involving the governments of Japan, the United Kingdom, the Federal Republic of Germany, France, Italy, and Sweden are reported. The research status of integrated vehicle systems, research safety vehicles, the international ESV test, vehicle subsystem research including crash energy management by vehicle structures (including safety school bus), restraint systems, biomechanics, crash avoidance, and a safety motorcycle, and management and coordination of international program and meetings, organization, program schedules, and miscellaneous other items are presented. Appendices include summaries of tests conducted on a Fiat 2500 B ESV; front-to-front impact at 50 mph and a Toyota ESV; front-to-rear impact at 60 mph. A summary of the Calspan Corporation's and Minicars' RSV preliminary specifications is included along with an extract of the executive summary from "NHTSA Highway Safety Forecast and Assessment--A 1985 Traffic Safety Setting".

National Hwy. Traffic Safety Administration, Office of
Vehicle Safety Res., Washington, D.C. 20590
Rept. No. PR-(Jan-Jun)-75 ; 1975; 52p
Availability: Reference copy only

HS-801 817

MULTIDISCIPLINARY ACCIDENT INVESTIGATION SUMMARIES VOL. 7, NO. 1

Case reports of in-depth accident investigations are summarized. These investigations are being conducted to identify contributing factors and injury causation, to evaluate the effectiveness of countermeasures, and to detect design and functional problems of the vehicle and highway. The reports are individual, clinical studies of accidents, generally involving vehicles in the last three model years, of fatal, injury producing, or property damage severity. Each summary consists of identification information including time, date, and location of the accident, a description of the highway, vehicles, drivers, and occupants involved, a narrative of the sequence of events of the collision including details of the precrash, crash, and postcrash phases, an assessment of injuries and damage, and a list of applicable standards, causal factors, conclusions, and recommendations. A diagram of each collision is included. Summaries of 51 case reports are given.

National Hwy. Traffic Safety Administration, Office of
Accident Investigation and Data Analysis
1976; 366p
Availability: NTIS

HS-801 818

MULTIDISCIPLINARY ACCIDENT INVESTIGATION SUMMARIES, VOL. 7, NO. 2

Case reports of in-depth accident investigations are summarized. These investigations are being conducted to identify contributing factors and injury causation, to evaluate the effectiveness of countermeasures, and to detect design and functional problems of the vehicle and highway. The reports are individual, clinical studies of accidents, generally involving vehicles in the last three model years, of fatal, injury producing, or property damage severity. Each summary consists of identification information including time, date, and location of the accident, a description of the highway, vehicles, drivers, and occupants involved, a narrative of the sequence of events of the collision including details of the precrash, crash, and postcrash phases, an assessment of injuries and damage, and a list of applicable standards, causal factors, conclusions, and recommendations. A diagram of each collision is included. Summaries of 50 case reports are given.

National Hwy. Traffic Safety Administration, Office of Accident Investigation and Data Analysis
1976; 360p
Availability: NTIS

HS-801 853

A GUIDE TO REFERENCE SERVICES IN THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Reference services of the National Highway Traffic Safety Administration include the following: a monthly current awareness journal, Highway Safety Literature; the Technical Reference Branch, for the use of NHTSA staff, and its reference service for the research community generally; and a literature search service (for which a fee is charged). The reference service collections include NHTSA publications, staff reports, and a variety of relevant materials. A table is given which presents the collections (Highway Safety Literature, program reports other than research and development, audio-visuals, specifications, docket, and general reference) according to their series title, series prefix and numbering system, data of first in the series, approximate number of items, format, indexing and uses.

by Winifred F. Desmond
National Hwy. Traffic Safety Administration, Technical Reference Branch, Washington, D.C. 20590 Highway Safety Literature 76-01 pA1-A10 (30 Jan 1976)
1976; 6refs
Availability: See publication

HS-801 858

ANALYZING THE ROLE OF DRIVER/VEHICLE INCOMPATIBILITIES IN ACCIDENT CAUSATION USING POLICE REPORTS

An analysis of police accident reports from North Carolina was conducted to determine whether driver problems with vehicle controls, vehicle visibility systems, or vehicle lighting contribute to automobile accidents. By enumerating the various real-world, accident-related problems experienced by drivers with these vehicle systems, the analysis reinforces the

findings from past analytical and experimental studies that have identified deficiencies in the designs of hand controls, foot controls, adverse-weather visibility systems, rear view mirrors, and glaring headlights. The major drawback with this approach is that the data base cannot be used to accurately estimate the magnitudes of the problems. Its limitations include the following: the narratives may be biased, lack of the definitive report criteria may result in faulty search-word retrieval, and grammar and sentence construction sometimes result in ambiguity.

by Michael Perel
National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Res.
1976; 16p
Technical Note.
Availability: NHTSA

HS-801 895

TECHNICAL REPORTS OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION: A BIBLIOGRAPHY, 1973-1975

This bibliography cites documents published from January 1974 to December 1975. Citations follow the format used in the monthly abstract journal Highway Safety Literature, indexed by a keyword-out-of-context (KWOC) listing, author, corporate author, contract number, and report number. Documents listed herein may be examined in the Technical Reference Branch, National Highway Traffic Safety Administration. Few of the documents are available for distribution by NHTSA. Availability is given in individual entries.

by Lois Flynn
National Hwy. Traffic Safety Administration, Technical Services Div., Washington, D.C. 20590
Rept. No. SB-05; 1976; 288p
Supplement to bibliography for the period 1967-1973, HS-801 200.
Availability: NTIS
1976; 41p
Availability: GPO

HS-801 897

EVALUATION FACTORS FOR PERFORMANCE OF POLICE TRAFFIC SERVICES. TECHNICAL REPORT. FINAL REPORT

A description is given of the process of developing a model job description of police traffic services tasks (or subtasks) performed by patrolmen, which could be used as factors in a personnel evaluation system. Information given includes the approach, literature review, and data collection. Although the details of the model job description are in a separate report this report does describe its general nature and given sample segments. The validity of results, feasibility of developing an evaluation system and utility of performance evaluation are also discussed. The necessity of having the evaluation system accepted by the police community is stressed; it must also be integrated with other job-performance measures such as at-

titude, appearance. NHTSA should consider putting the strength of its image behind the use of this evaluation system.

by Edward W. Bishop; John F. Oates; John Hamilton
Dunlap and Associates, Inc., 1 Parkland Drive, Darien, Conn.
06820

Contract DOT-HS-5-01272

1976; 71p 52refs

Rept. for 30 Jun 1975-31 Mar 1976. See also HS-801 898.

Availability: NTIS

HS-801 898

EVALUATION FACTORS FOR PERFORMANCE OF POLICE TRAFFIC SERVICES. MODEL JOB DESCRIPTIONS. FINAL REPORT

A model job description is given which enumerates and describes the duties and tasks of a traffic patrolman in the categories of traffic law enforcement, accident scene management and investigation, traffic direction and control, court system interaction, and motorist assistance. These are the factors that may be included in a personnel evaluation system in the field of police traffic services. The description also includes a definition of the characteristics that will determine the evaluation utility of each factor, such as its products, observability, universality, training, and gradations.

by Edward W. Bishop; John F. Oates; John W. Hamilton
Dunlap and Associates, Inc., 1 Parkland Drive, Darien, Conn.,
06820

Contract DOT-HS-5-01272

1976; 81p 1ref

Rept. for 30 Jun 1975-31 Mar 1976. See also HS-801 897.

Availability: NTIS

HS-801 899

DETERMINATION OF SAMPLE SIZE BASED ON ALPHA AND BETA RISKS

A set of sampling tables has been developed as an aid to the designer of experiments (such as evaluation of traffic safety demonstration programs) and one who has some knowledge concerning the sampling theory. Tables introduce the use of "Power of the Test" in determining sample size and show what tradeoffs can be made in sample size by varying the requirements of Type I and Type II errors (alpha and beta). It is important that these considerations be made so that either more demonstration sites can participate and/or reduced costs can be effected through smaller sample sizes.

by Jyoti Surti; Paul Levy
National Hwy. Traffic Safety Administration, Office of Driver
and Pedestrian Programs

1976; 10p

Technical Note.

Availability: Corporate author

HS-801 907

A SOLID STATE DIGITAL DATA RECORDER FOR MONITORING ANTHROPOMORPHIC DUMMY IMPACT ENVIRONMENTS. FINAL REPORT

The solid state digital data recorder was designed to be a very general miniature data acquisition system, mounted in the pel-

vic assembly of a 50th percentile anthropomorphic dummy. An eight-channel system was evaluated in a sled test series simulating a 30 mph vehicle-barrier impact. Head drop testing was conducted in which three recording channels were connected to a triaxial accelerometer mounted at the center of gravity of the dummy head. The first system tests involved a series of head drops onto a steel plate. The head was detached from the dummy's body which contained the solid state recorder. The objective of this test series was to verify general three channel recorder/dummy system operation. The dummy/recorder system was also evaluated in five vehicle collisions. During these tests the system successfully captured and stored impact information on all thirteen collisions in which it participated.

by Randolph J. Wolf

Kaman Sciences Corp., 1500 Garden of the Gods Rd.,
Colorado Springs, Colo. 80907

Contract DOT-HS-4-00927

Rept. No. K-76-28U(R) ; 1976; 74p

Availability: NTIS

HS-801 909

TRAFFIC SAFETY. A REPORT ON ACTIVITIES UNDER THE HIGHWAY SAFETY ACT OF 1966, JANUARY 1, 1975--DECEMBER 31, 1975

The administration of the Highway Safety Act of 1966, as amended, is outlined, and those provisions of the Highway Safety Act of 1973 in which Congress expressed special interest are addressed. Specific reporting requirements of the 1966 Act include: a statistical compilation of the accidents and injuries occurring in 1974; a list of all safety standards issued or in effect during 1975; the scope of observance of applicable Federal standards; a statement of enforcement actions during the year, including judicial decisions, settlements, and pending litigation; a summary of all current research grants and contracts, together with a description of the problems to be considered by the grantees and contractors; an analysis and evaluation of completed research activities and technological progress achieved during the year, and the resulting police recommendations; an analysis of the effectiveness of State highway safety programs; a statement on the extent to which technical information was disseminated to the scientific community. A short description of the genesis of the NHTSA is included together with a summary of NHTSA-FHWA (Federal Highway Administration) activities over the last nine years. The safety benefits derived from the 55 mph national speed limit, which was adopted as a fuel conservation step, are described. Throughout 1974 and 1975, the Nation has experienced a reduction of approximately 17% in the number of people killed on the highways, as compared with 1973. Steps described which were taken to lessen pedestrian fatalities in 1975 include the identification of specific types of pedestrian accidents and remedial efforts directed at these accident types (seven have been identified), including training programs, codes and laws, public information and education materials, and environmental design changes. The NHTSA's alcohol countermeasure program is reported to have been maintained as a high priority. Data are now available covering three years of operation for 29 of the 35 Alcohol Safety Action Projects centering on the major areas of enforcement, adjudication, rehabilitation, and public information. Progress in the specific programs of the NHTSA and the FHWA are reviewed, including human resources development and training, international cooperation, and data acquisition, analysis, and reporting. Discussion of highway safety program standards emphasizes

traffic law uniformity, traffic courts, and traffic records systems, with a summary of the standards included. Pedalcyclist, motorcyclist, and pupil transportation safety, as well as driver licensing and the National Driver Register are treated. Safer vehicles through inspection programs and standards are mentioned. Safe highway programs including their management, state programs, new developments, and pedestrian and bicycle safety are examined. Crash survival material includes emergency medical services and military assistance to safety and traffic. Consumer service and public information are mentioned. Research topics of current grants and contracts are individually summarized. Appendices include a statistical compilation, NHTSA publications (with a Federal Highway Administration supplement), and current research grants and contracts and the problems they address.

National Hwy. Traffic Safety Administration; Federal Hwy. Administration
1975; 191p
Rept. by the President of the United States to the Congress, 1975.

Availability: NHTSA

HS-801 910

MOTOR VEHICLE SAFETY. A REPORT ON ACTIVITIES UNDER THE NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT OF 1966 AND THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT OF 1972

The administration of the National Traffic and Motor Vehicle Safety Act of 1966, and the Motor Vehicle Information and Cost Savings Act of 1972 is outlined. Due to many factors, including the imposition of the 55 mile per hour speed limit, the number of traffic deaths per 100 million miles of travel is decreasing. This report summarizes the motor vehicle safety standards and discusses crash survivability and crash avoidance as related to vehicle design. It also reports on safety defect recalls and investigations, consumer service, research, and litigation and enforcement activities of 1975, and on special programs including international cooperation, the Research Safety Vehicle program, the National Driver Register, the Engineering Test Facility, and NHTSA data systems. Accident statistics and a list of publications by NHTSA are also given.

National Hwy. Traffic Safety Administration; Federal Hwy. Administration
1975; 179p
Rept. for 1 Jan-31 Dec 1975. Rept. by the President of the United States to the Congress, 1975.
Availability: NHTSA

HS-801 911

TIRE TREADWEAR VALIDATION. EXECUTIVE SUMMARY REPORT. FINAL REPORT

by William Barreire
Hodges Transportation, Inc., Nevada Automotive Test Center,
P.O. Box 234, Carson City, Nev. 89701
Contract DOT-HS-4-00920
Rept. No. 20-1-884; 1976; 26p
Rept. for 4 Jun 1974-15 Nov (1975). For abstract, see HS-801 912.
Availability: NTIS

HS-801 912

TIRE TREADWEAR VALIDATION. VOL. 1, TECHNICAL REPORT. FINAL REPORT

This report is a broad, technical study of the fundamental parameters, testing methodology, techniques, and equipment necessary to evaluate treadwear rate differentials among candidate tire groups. A methodology for accelerating tire treadwear is developed. This methodology is based on the fact that the distance a tire slides, not the distance it rolls, causes tire wear, and it relates tire rubber loss to tire slip energy (the product of the tire slip forces and the tread-interface slip distance). The results of accelerated wear test correlated well with road wear rates for two especially compounded retread tire groups, and preliminary accelerated wear tests on twelve groups of tires indicate that this method may also be used to indicate wear differentials among tires of different construction and tread design.

by William Barreire
Hodges Transportation, Inc., Nevada Automotive Test Center,
Carson City, Nev. 89701
Contract DOT-HS-4-00920
Rept. No. 20-1-884-TR; 1976; 264p
Rept. for 4 Jun 1974-15 Nov 1975. For Executive Summary, see HS-801 911. Vol. 2, Instrumentation Manual, consists of aperture cards which can be viewed at Technical Reference Service, NHTSA.
Availability: NTIS

HS-801 913

DESIGN FOR NASS: A NATIONAL ACCIDENT SAMPLING SYSTEM. VOL. 1: TEXT. PHASE 1 FINAL REPORT

A design is presented for a national accident investigation program, NASS, based on sampling theory. By limiting the number of investigations within a strict sampling plan it is possible to record sufficient detail about each accident to produce national estimates of injury, property damage, and other accident characteristics which will be useful in cost-benefit analyses. The system described has three major facets--a program for continuous acquisition of data of a random sample of all towaway-pedestrian-bicycle-motorcycle accidents occurring in the U.S., a program for occasional acquisition of additional data on selected topics quickly and on-call, and a program for conducting in-depth or multidisciplinary accident investigations for accidents of particular interest. While alternative approaches are discussed, the system recommended consists of 35 primary sampling units distributed throughout the 48 contiguous states. The design is complete and the system is ready for pilot implementation. Full implementation is possible over a period of three years.

by J. O'Day; A. Wolfe; R. Kaplan
Highway Safety Res. Inst., Univ. of Michigan, Ann Arbor, Mich. 48105
Contract DOT-HS-4-00890
Rept. No. UM-HSRI-SA-75-14-1; 1976; 160p
Rept. for Jun 1974-Jul 1975. Vol. 2 is HS-801 914.
Availability: NTIS

HS-801 914

HSL 76-11

HS-801 914

DESIGN FOR NASS: A NATIONAL ACCIDENT SAMPLING SYSTEM. VOL. 2: APPENDICES. PHASE 1 FINAL REPORT

The accident population to be considered is outlined in Appendix A. A description of the program employed to enter accident data follows in Appendix B. Appendix C describes the sampling error program package (SEPP) which currently consists of three sets of computer programs which compute sampling errors. A computer listing of 1,241 potential primary sampling units within their controlled-selection cells, with cumulative populations in each cell, is provided in Appendix D. A listing of the questions which form the basis for the NASS design is given, along with a collection of sample field data forms, and the field investigator's coding manual. Finally, a specific description of job requirements, duties, and desirable backgrounds for NASS employees is provided in Appendix H.

by J. O'Day; A. Wolfe; R. Kaplan
Highway Safety Res. Inst., Univ. of Michigan, Ann Arbor, Mich. 48105
Contract DOT-HS-4-00890
Rept. No. UM-HSRI-SA-75-14-2; 1976; 191p
Rept. for Jun 1974-Jul 1975. Includes "Multipurpose Programs for Sampling Errors," by Leslie Kish (Univ. of Michigan Inst. for Social Res.). Vol. 1, Text is HS-801 913.
Availability: NTIS

HS-801 915

PSYCHOSOCIAL IDENTIFICATION OF DRIVERS RESPONSIBLE FOR FATAL VEHICULAR ACCIDENTS IN BOSTON. FINAL REPORT, PT. 1

This report contains the results of an investigation of the historical and focal human-factor variables associated with the operators of motor vehicles initially judged to have been the "most responsible" operators for vehicular accidents in the greater Boston area resulting in a personal fatality to the focal operator, another vehicle occupant, or a pedestrian. The areas of primary interest presented in this report on 300 operators include: demographic and psychosocial variables, historical patterns of alcohol use and focal accident alcohol involvement, historical patterns of marijuana and street/entertainment drug use and focal accident involvement, the Risk Taking Behavior Scale (RTBS) and the focal Human Factor Stress Scale (HFSS). Within the sample of 267 operators whose data are included in the report, 103 (38%) were involved in Type 1 accidents where they were killed in the focal collision, 63 (24%) were in Type 2 accidents where they survived the collision resulting in fatal injuries to another vehicular occupant, and 101 (38%) were driving a vehicle which killed a pedestrian (Type 3). The Type 2 operator was significantly different, historically and focally, from the others. His life-style was multi-problematical from domestic, social, legal, and risk-taking behavior perspectives. The Type 1 operator was significantly older and showed historical and focal patterns of heavier alcohol use. His psychosocial problem areas were more in conformity with the acceptable, acting-out behaviors of society. The Type 3 operator was considerably more passive in

his human factor histories and was speculated to have been more like the "average" Boston driver.

by Robert S. Sterling-Smith
Traffic Accident Res. Prog., Boston Univ. School of Law, 141 Bay State Rd., Boston, Mass. 02215
Contract DOT-HS-310-3-595
1976; 216p 20refs
Rept. for Sep 1971-Dec 1973. For Parts 2 and 3 see HS-801 916 and HS-801 917.
Availability: NTIS

HS-801 916

AN ANALYSIS OF DRIVERS MOST RESPONSIBLE FOR FATAL ACCIDENTS VERSUS A CONTROL SAMPLE. FINAL REPORT, PT. 2

An investigation is presented of 267 motor vehicle operators judged to have been most responsible for a highway fatality in the greater Boston area. These were analyzed with respect to accident type (whether it was the driver, another vehicular occupant, or a pedestrian that was killed) and alcohol involvement. These types are compared with each other and with a matched control sample of 801 operators never responsible for a fatal highway accident in order to establish pre-identification and predictive variables identifying operators who might be potential candidates for a fatal highway accident. The variables most significant for the discriminant function analysis used included: previous arrests for driving while intoxicated and speeding, alcohol use patterns, levels of education and occupation. Variations with respect to age, sex, marital status, physical and mental health, ethnic background, cigarette smoking habits, involvement in high-risk leisure activities and marijuana and street or entertainment drug use were also considered. The results detailed a Boston Predictive Formula for identifying potentially high-risk operators from the general population.

Traffic Accident Res. Proj., Boston Univ. School of Law, Boston, Mass. 02215
Contract DOT-HS-310-3-595
1976; 174p 5refs
For parts 1 and 3, see HS-801 915 and HS-801 917.
Availability: NTIS

HS-801 917

MARIJUANA AND DRIVER BEHAVIORS: HISTORIC AND SOCIAL OBSERVATIONS AMONG FATAL ACCIDENT OPERATORS AND A CONTROL SAMPLE. FINAL REPORT, PT. 3

An analysis and evaluation are presented of the data from 1068 motor vehicle operators in the greater Boston area with a focal interest in marijuana use patterns and corresponding demographic, psychosocial, alcohol, and other drug and vehicular variables. The two samples contributing this presentation include 267 (25%) experimental operators who were "most responsible" for a highway accident in the greater Boston area resulting in a personal fatality to an operator, other vehicular occupant or a pedestrian, and 801 (75%) operators matched to the experimentals without any fatal accident histories, comprising the control sample. The experimental sample included 121 (45%) marijuana smokers and 146 (55%) nonsmokers, with the control sample showing 272 (34%) marijuana smokers and 529 (66%) nonsmokers. Notable dif-

ere observed between these 4 subsamples and : smokers and the nonsmokers. In broad terms the : kers were over-achievers and the experimental :er-achievers. The control smokers were more suc- : their education and occupation than were the ex- :smokers. Other observations were collected from :ntrol smokers relative to subjective impressions of : alterations when marijuana-intoxicated and a : more objective variables associated with marijuana :s. The control operator smoking group presented :ative to the level of risk in operating a motor vehi- :a-influenced and when marijuana-sober. They felt :ber of mental and physical tasks associated with :e impaired by smoking marijuana, in particular, : an unfamiliar road, driving in heavy traffic and :nfamiliar vehicle.

: Sterling-Smith; David D. Graham
ident Res. Proj., Boston Univ. School of Law,
ss. 02215

OT-HS-310-3-595

33refs

ap 1971-Jun 1975. For parts 1 and 2, see HS-801

-801 916.

: NTIS

ND MEDICAL-LEGAL FOUNDATION, INC., SCIPLINARY ACCIDENT INVESTIGATION. INAL REPORT

dology, results, conclusions, and recommendations :o the investigation of 52 vehicular accidents occur- :reater Baltimore metropolitan area are described. : fatal and twenty-six nonfatal accidents were in- :Particular emphasis was placed upon the human :ect of the vehicle accident. The investigations in- :icles and scene examination, autopsy findings on :is, toxicological data and psychosocial evaluations :fault" driver population. Alcohol and its effect upon :was considered a primary factor in the causation of : fatal accidents and 19% of the nonfatal accidents :d. Excessive speed was considered responsible for : fatal accidents and 30% of the nonfatal accidents. : the nonfatal accidents, driver inattention was con- :primary causative factor. Recommendations include :and punitive measures to reduce the instances of :der the influence of alcohol, enforcement of speed :encouraging the use of seat belts and shoulder har- :well as improved vehicular design, better designs :raffic signals and parts of highways, and removal of :azards.

S. Fisher; Irvin M. Sopher
Medical-Legal Foundation, Inc., 111 Penn St.,
Md., 21201

OT-HS-198-3-770

6refs

8 Jun 1973-24 Jun 1974. Vol. 2 is HS-801 919.

y: NTIS

HS-801 919

MARYLAND MEDICAL-LEGAL FOUNDATION, INC. MULTIDISCIPLINARY ACCIDENT INVESTIGATION. VOL. 2. FINAL REPORT

Some preliminary findings are described, emanating from a series of comprehensive, multivariate, statistical analyses of psychosocial data on fatally injured (N074) and nonfatally injured (N033) responsible (culpable) male drivers collected throughout the greater Baltimore metropolitan area over the seven-year period 1968 to 1974. The primary data collection instruments employed were the Katz Adjustment Scales-R Forms (KAS) and the Maryland Medical-Legal Psychosocial Questionnaire. Accompanying the report are appendices detailing the results of a large number of analyses involving the KAS. All analyses pertain to responsible male drivers only. Appendix I contains frequency distribution tables, respondents being male drivers responsible for fatal accidents. Some factors considered include race, birth rank, number of children in family, and marital difficulty as related to blood alcohol levels. Appendix II contains frequency distribution tables, respondents being male drivers, responsible for nonfatal accidents. Some factors considered include, height, race, education, personality characteristics, and drinking habits. The complex interrelationships among psychosocial factors and demographic and situational variables, such as age, alcohol involvement, and fatality status, are explored and discussed. It is concluded that psychosocial factors play an important role in the causation of serious traffic accidents. Attempts to find interrelationships between the KAS scores and variables from the structured portion of the psychological evaluation showed an absence of such relationships. The findings are consistent with earlier investigations that relate aggressiveness and emotional instability to accident involvement. Behavioral traits which are more prominent among male drivers involved in fatal accidents than among men in general include the following: more belligerent, verbally expansive, negative, suspicious, anxious, less withdrawn, showing more psychopathology, and hyperactive.

by Russell S. Fisher; Irvin M. Sopher
Maryland Medical-Legal Foundation, Inc., 111 Penn St.,
Baltimore, Md. 21201

Contract DOT-HS-198-3-770

1976; 74p 6refs

Rept. for 28 Jun 1973-24 Jun 1974. Vol. 1 is HS-801 918.

Availability: NTIS

HS-801 920

NEW TRENDS IN ADVANCED TRAFFIC ADJUDICATION TECHNIQUES

A discussion is presented concerning the problems of the traditional court system in handling traffic matters, new concepts designed to improve the existing system, potential for change in the court system, and facilities available to state and local governments to assist in advisable revisions. Problems of the existing court system in handling traffic matters include effective deterrence, rehabilitation, and suitable penalties. New concepts for improvement include modification of the existing judicial system as applicable to traffic matters, modification of the judicial approach to include parajudicial authority, and change to administrative adjudication in traffic cases. Steps by which interested jurisdictions can change what is now happening in the courts include: separation of accident cases from administrative cases (such as licensing); decriminalization of the low-risk category traffic offenses; and the recognition and

treatment of individual driver problems relating to performance and attitude. Several recent court decisions which have had important implications in the adjudication of traffic offenses are discussed. Among these implications are: where there is a possibility of a jail sentence for any felony, misdemeanor, or petty offense, a person is entitled to a court appointed attorney if he cannot afford to hire one; a defendant has the right to a trial by jury under the Sixth Amendment if his offense is punishable by a potential jail term in excess of six months; and the New York State Legislature may constitutionally authorize administrative rather than judicial adjudication of traffic infractions. It also established "clear and convincing evidence" as the required quantum of proof for a determination of guilt where such determination could result in the imposition of a fine, but not imprisonment. Procedures are described by which implementation of advanced traffic adjudication techniques may be achieved. They include: the determination of what type of system would be most appropriate for the jurisdiction under consideration; the examination of those existing statutes which must be revised to allow for the desired changes; the organization of a conference with state leaders in order to achieve the implementation of planned changes; the preparation and development of a legislative package which is reflective of desired changes; the collection of support for changes from judicial, law enforcement and public areas; and the establishment of a modified adjudication system through enabling legislation. More effective data retrieval systems are recommended to effect needed changes in reporting, correlation, and study of interrelated driver problems. Assistance in revision of court systems is available through the NHTSA and the Law Enforcement Assistance Administration of the Department of Justice.

National Hwy. Traffic Safety Administration, Washington, D.C.
1976; 36p 15refs
Availability: NHTSA

HS-801 921

PERFORMANCE EVALUATION OF CHILD TEST DUMMIES. VOL. 1: TECHNICAL REPORT. FINAL REPORT

Commercially available three- and six-year-old child dummies, manufactured by Alderson Research Labs and Sierra Engineering Company, were evaluated for their anthropometric measurements and dynamic response characteristics in pendulum impact tests and simulated crashes in representative automobile-child seat restraint environments. Simulated crashes included 20- and 30-mile-per-hour (mph) frontal and 20-mph side impacts on automobile and specially designed bench seats. Two types of child seats, the GM "Love Seat" and Chrysler "Mopar," were selected for testing as representative of belt and padding restraint types currently in use. The three-year-old child dummies were found to be capable of providing repeatable measurements of the head and chest accelerations and head deflections in sled tests and to be sufficiently sensitive of detecting differences in the crash environments. Acceleration measurements with both six-year-old child dummies were found to contain resonances.

by Mahesh P. Shah; Vladislav G. Radovich
Transportation Res. Center of Ohio, East Liberty, Ohio 43319
Contract DOT-HS-370-3-780
1976; 258p 4ref
Rept. for 29 Nov 1973-15 Aug 1974. For Vol. 2, appendix, see HS-801 922.
Availability: NTIS

HS-801 922

PERFORMANCE EVALUATION OF CHILD TEST DUMMIES. VOL. 2: APPENDIX. FINAL REPORT

Samples of the computer-calculated data packages produced for each dummy test are presented. The digital data contained in the Appendix correlates with descriptions and data parameters discussed in the main body of the report. Selected oscillograph traces are incorporated in the data package for Test 52 to permit review and correlation of digital data for this test. The oscillograph data was acquired using 1.65 KHZ (SAE Class 1000) filters for the dummy's head accelerometer outputs and 300 HZ (SAE Class 180) filters for the chest accelerometers. The digitized data was filtered using 2400 Hertz input filters in order to review the high-frequency ringing encountered during some tests. Slight signal amplitude differences can be noted between the digital data and oscillograph data, due to the different filtering techniques. The seat belt loads displayed in the computer plots do not include the seat belt pre-load values. The peak seat belt loads contained in the data parameters tables in the report test are corrected to include the respective preload values.

by Mahesh P. Shah; Vladislav G. Radovich
Transportation Res. Center of Ohio, East Liberty, Ohio 43319;
National Hwy. Traffic Safety Administration, Washington, D.C. 20590
Contract DOT-HS-370-3-780
1976; 267p
Rept. for 29 Nov 1973-15 Aug 1974. Appendix to Vol. 1, HS-801 921.
Availability: NTIS

HS-801 923

DEVELOPMENT OF A MOTOR VEHICLE MATERIALS HISTORICAL, HIGH-VOLUME INDUSTRIAL PROCESSING RATES COST DATA BANK (INTERMEDIATE TYPE CAR). FINAL REPORT

A study was carried out to identify and establish a motor vehicle materials volume industrial processing cost data bank for the intermediate-type car. Efforts were divided among three methods: microanalysis in which various costs were generated using an industry-type estimating technique; macroanalysis in which various average costs were determined for a study of five years of historical financial records of an automotive corporation; and analysis of replacement parts catalog costs to estimate various component costs. In the microanalysis method, a 1975 intermediate-type production vehicle was obtained and dismantled, and its various components and subassemblies were analyzed in detail to determine the weight and estimated manufacturing cost associated with each item. From this data other categorical costs were estimated, in total for each item and on a cost per pound basis. Various items were grouped into several levels of assemblies on a basis of practiced industry groupings to arrive at total cost categories for a complete vehicle. The macroanalysis served as a means to provide data in certain areas that would substantiate the microanalysis. The replacement-parts method was studied with early results indicating variation in consumer cost of approximately 170 to 2,100% over consumer cost estimated by the microanalysis method. It is concluded that the replacement-

r 30, 1977

HS-801 932

d would require too much effort to develop results data bank, and it was therefore discarded.

R. Harvey; Daniel J. Chupinsky
Engineering and Mfg. Co., 2500 E. Nine Mile Rd.,
Ch. 48091
DT-HS-5-01081

: NTIS

12. BI-MONTHLY PROGRESS REPORT ARCH 17, 1976 TO MAY 16, 1976

ary design review has held to plan builds for RSV
ictures 3, 4, and 5. The full-scale crash test matrix
cable with the structures to be built was reviewed
d with respect to performance velocities and front
pact. Principal progress and problems are reported
general vehicle design (body glove development,
design, braking system developing, handling system
it, electronics, and weight analysis), structure
development (fabrication, component testing, static
amic testing, and static crush testing of side struc-
restraint system development (driver and passenger
nd impact protection). Problems highlighted include
the fabrication of Build 3 due to extensive changes
structure from Build 2 status. Provision is being made to
implement the fabrication of Build 4 through pre-
l preparation of design materials and plans. Appen-
vide significant correspondence, subcontractors
ports, and test data.

Inc., 35 La Patera Lane, Goleta, Calif. 93017
DOT-HS-5-01215
PR-5 ; 1976; 204p
y: Reference copy only

9

ANNUAL FOR AIR BAG RESTRAINT ABAG 19. FINAL REPORT

tasks covered by the current, ABAG 19, program
analyze the ABAG 19 program listing and identify
nd/or modifications to the earlier ABAG 2 program;
le a coherent description of the identified modifica-
plying text, equations, diagrams, flow charts, and
equired; to convert the existing BASIC0 computer
to FORTRAN IV, as employed by the Honeywell
outer; to prepare a report which represents the above
a user-oriented document which repeats, where
all of the original ABAG 2 data.

Dufort
nc., 4524 Bailey Ave., Buffalo, N.Y. 14226
NHTSA-6-5328; Ref: FH-11-7574
VCR-76-1; 1976; 122p
r Nov 1975-Mar 1976. This work is an extension of
air bag program performed by the Cornell
cal Laboratory, Inc., Jul 1970-Sept 1971.
ty: NTIS

HS-801 930

HAZARDOUS MATERIALS. EMERGENCY ACTION GUIDE

A guide to assist emergency service personnel during the ini-
tial stages of an incident involving a spill of a volatile, toxic,
gaseous, and/or flammable material that is shipped in bulk is
presented. General and specific safety procedures for person-
nel to follow are provided in spill guide sections arranged
alphabetically by hazardous material involved. Under each
material identified, information is given on potential hazards
and immediate action information for fires, spills, and first
aid, including functions and services for those with ap-
propriate resources and equipment. Information is also given
on recommended evacuation areas and distances for public
protection from dangerous concentrations of toxic vapors and
explosions, including water pollution controls. Procedures to
follow when assistance is needed or when appropriate
resources and equipment are not available are also supplied.
Hazardous materials discussed are acrolein, acrylonitrile, am-
monia, anhydrous ammonia, boron trifluoride, bromine, car-
bon disulfide, chlorine, dimethylamine, dimethyl ether,
dimethyl sulfate, epichlorohydrin, ethyl chloride, ethylene,
ethyleneimine, ethylene oxide, fluorine, hydrocarbon fuels,
liquid hydrogen, hydrogen chloride, hydrogen cyanide,
hydrogen fluoride, hydrogen sulfide, liquid petroleum gas,
liquid methane, anhydrous methylamines, methyl bromide,
methyl chloride, methyl ethyl ether, methyl mercaptan,
monomethylamine, fuming nitric acid, nitrogen tetroxide,
oleum/sulfur trioxide, liquid oxygen, phosgene, phosphorus
trichloride, propane/LPG, sulfur dioxide, sulfur trioxide,
titanium tetrachloride, trimethylamine, and vinyl chloride.

National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
1976; 92p
Availability: NHTSA

HS-801 931

BICYCLE SAFETY: A SUBJECT BIBLIOGRAPHY FROM HIGHWAY SAFETY LITERATURE

Abstracts on the subject of bicycle safety are compiled from
the Highway Safety Literature collection. The abstracts are in-
dexed by key subject word (KWOC), author, corporate
author, contract and report numbers. Availability for the items
listed is noted. Documents cited can be examined in the
Technical Reference Branch of the National Highway Traffic
Safety Administration.

National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
Rept. No. SB-2 ; 1976; 80p
Availability: NHTSA

HS-801 932

RESTRAINT SYSTEMS: A SUBJECT BIBLIOGRAPHY FROM HIGHWAY SAFETY LITERATURE

Abstracts on the subject of restraint systems are compiled
from the Highway Safety Literature collection. The abstracts
are indexed by key word, out of context, author, corporate
author, contract and report numbers. Availability for the items
listed is noted. Documents cited can be examined in the

HS-801 933

Technical Reference Branch, National Highway Traffic Safety Administration.

National Hwy. Traffic Safety Administration, Washington, D.C., 20590
Rept. No. SB-4 ; 1976; 134p
Availability: NHTSA

HS-801 933

HIGHWAY SAFETY EFFECTS OF THE ENERGY CRISIS ON U.S. TOLL ROADS. FINAL REPORT

Data concerning accidents, traffic volumes, and speeds of travel--broken down by vehicle class into passenger cars and large trucks--are analyzed for five toll roads. Passenger car traffic was reduced about 15% and average speeds by about 8 miles per hour as a result of the energy crisis. The speeds of large trucks were reduced about 4 miles per hour, but truck traffic did not change appreciably. Accident data were analyzed using three exposure models to permit a better understanding of the process involved. Accident rates overall were reduced much more than could be accounted for by travel alone. Accident severity was apparently reduced leading to 47% reduction in fatalities. The number of all casualties including minor injuries decreased slightly. While both car and truck accident involvements were reduced, large trucks were over-represented in the two-vehicle accident population both before and after the energy crisis.

by K. Campbell; R. Scott; S. Tolkin
Highway Safety Res., Inst. Univ. of Michigan, Ann Arbor, Mich. 48105
Contract DOT-HS-4-00980
Rept. No. UM-HSRI-76-5; PB-254 678; 1976; 149p
Rept. for Jul 1974-Feb 1976.
Availability: NTIS

HS-801 934

REPORT ON THE DEVELOPMENT OF PRELIMINARY BREATH TEST LAWS IN THE UNITED STATES

Development and comparison of provisions of preliminary breath test laws in the United States are discussed. Twelve states (Florida, Indiana, Maine, Minnesota, Mississippi, Nebraska, New York, North Carolina, North Dakota, South Dakota, Vermont, and Virginia) have specific preliminary breath test laws, while Maine, Nebraska, New York, North Dakota, and South Dakota have laws which can be applied in the instance of an accident or traffic violation. The other states have laws which feature the need for reasonable grounds or probable cause on the part of the enforcement officer before such a test can be requested. Each of the state laws with respect to breath testing is compared with respect to criteria for use, penalty provision for refusal, use of evidence, method of testing, and individual remarks. These laws have come about through the need for testing for driving while under the influence of alcohol before an arrest is made. Provision of such laws as enforcement tools may be implemented by meeting certain conditions meant to withstand a constitutional attack on their application. Such conditions relate to non-intrusiveness of the test, adjunct use of the breath test with other sobriety test(s), concession of a right to search under the situations involved, reasonable grounds to believe a violation was involved to key application of the test, follow-up

with evidential testing with consent, license issuance and suspension controls, convenience to the motorist, and safety implications. Further development and application of the preliminary breath test under law is recommended. A four-page table entitled "Comparison of Provisions of Preliminary Test Statutes" is provided.

by Phillip C. Dozier
National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Programs, Washington, D.C.
1976; 15p 8refs
Technical note.
Availability: NHTSA

HS-801 935

HANDLING TEST PROCEDURES FOR PASSENGER CARS PULLING TRAILERS. VOL. 1: SUMMARY REPORT. FINAL REPORT

by Donald E. Johnston; John E. Zellner; Irving L. Ashkenas
Systems Technology, Inc., 13766 South Hawthorne Blvd., Hawthorne, Calif. 90250
Contract DOT-HS-4-00900
Rept. No. TR-1052-1-vol-1; 1976; 21p 2refs
Rept. for 21 Jun 1974-31 Jul 1975. Vol. 2, Technical report, is HS-801 936; Vol. 3, Appendices, is HS-801 937. For abstract, see HS-801 936 and 801 937.
Availability: NTIS

HS-801 936

HANDLING TEST PROCEDURES FOR PASSENGER CARS PULLING TRAILERS. VOL. 2: TECHNICAL REPORT. FINAL REPORT

The development and validation of handling test procedures for car/trailer (articulated) vehicle combinations is described. Some 20 different limit and sublimit maneuvers are investigated. Four pragmatic test procedures are selected and defined which enable discrimination of handling characteristics on the basis of quantitative performance parameters. The test maneuvers (step steer, pulse steer, brake-in-straight-line, and brake-in-turn) are representative of realistic sublimit and emergency driving situations. The maneuvers and performance parameters are demonstrated to be applicable to a broad range of car/trailer combinations and hitch loading configurations; pertinent to both transient and steady-state dynamic properties, reasonable in cost, and practicable and applicable in diverse geographical regions of the United States or foreign countries. The tests also indicate points at which car/trailer handling was so unstable that it was unsafe and it is suggested that these be used to develop safe handling criteria.

by Donald E. Johnston; J. W. Zellner; Irving L. Ashkenas
Systems Technology, Inc., 13766 South Hawthorne Blvd., Hawthorne, Calif. 90250
Contract DOT-HS-4-00900
Rept. No. TR-1052-1-vol-2; 1976; 138p 10refs
Rept. for 21 Jun 1974-31 Jul 1975. For Vol. 1, Summary Rept., see HS-801 935; Vol. 2, Appendices, is HS-801 937.
Availability: NTIS

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endices, which elaborate and support the findings in the technical report, include the development of and simulation models, listings of simulation input representative test vehicles, and time histories of the icle responses for simulation validation. Additional ata derived from the finalized step steer tests are nted.

L. Ashkenas; L. Gregor Hofmann; Richard H. Klein; ellner
echnology, Inc., 13766 South Hawthorne Blvd.,
e, Calif. 90250
DOT-HS-4-00900
TR-1052-1-vol-3; 1976; 130p 5refs
21 Jun 1974-31 Jul 1975. Vol. 1, Summary, is HS-801
ol. 2, Technical report, is HS-801 936.
y: NTIS

8

SAFETY EFFECTS OF FUEL SHORTAGE ED LIMITS: A SUBJECT BIBLIOGRAPHY IGHWAY SAFETY LITERATURE

on the traffic safety effects of the fuel shortage and its are compiled from the Highway Safety Literature . The abstracts are indexed by key subject word out t, author, corporate author, contract and report num- lability for most publications is noted. Documents / be examined in the Technical Reference Branch, Highway Traffic Safety Administration.

Hwy. Traffic Safety Administration, Washington,
0
SB-3 ; 1976; 53p
ty: NHTSA

39

ESTS OF THREE-POINT SYSTEMS ING AIR BELT RESTRAINTS. FINAL F

rimental test program was conducted utilizing five ned cadavers and one anthropomorphic test dummy d tests to evaluate a standard three-point belt system ir belt which inflates during impact. The tests were d on the Calspan HYGE sled facility simulating 30 ital collisions for the three-point belts and 47 mph ollisions for the air belt systems. Attachment design three-point belt was shown to affect submarining na: danger of injury to the lower abdominal region is by attaching the lap belt to the seat instead of to the rame. Injuries occurring in the cadavers tested are l with relation to contact with the restraint system. davers suffered injury to the upper abdominal organs nsive damage to the thoracic cage. Liver lacerations ibuted to the tendency of the shoulder strap to rope n itself) and underride the rib cage on the right hand merous rib and sternum fractures may have been y the same phenomenon. However, it is pointed out e observed rib and sternum fractures of cadaver sub-

jects appeared to be more prevalent than they are in vivo sub- jects, this problem should be investigated further with the ob- jective of defining the failure mechanism, thereby defining a remedy for it. Test conclusions show that three of the five cadavers would have suffered fatal injuries and two would have suffered painful, but not life-endangering injuries, if they had been live subjects. Cadavers tested with the air belt system showed fewer injuries than those tested with the three- point belt system.

by Michael J. Walsh
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221
Contract DOT-HS-5-01017
Rept. No. ZP-5852-V-1; 1976; 155p
Rept. for Jan-Oct 1975.
Availability: NTIS

HS-801 940

THE RANDOMIZED RESPONSE TECHNIQUE: A REVIEW AND APPLICATION

An interviewing technique called Randomized Response Technique (RRT) is described and examined for potential use in the field of highway safety research. The RRT was developed to encourage interviewee cooperation and truthfulness by allowing the respondent to select a question on a probability basis from two or more questions without revealing the selection to the interviewer. Development of the interview method is described in detail with respect to identifying and allowing bias among respondents. Field research with RRT has been conducted on such topics as illegitimacy, abortion, and drug usage; efforts to extend application of RRT in the area of highway safety are described. Pilot studies conducted on seat-belt usage by means of the RRT were judged ineffective. It is suggested that the method failed in these applications because of the difficulties of adequate explanation of the technique, selection of appropriate randomizing device, and provision of sufficient motivation for response.

by Yosef Hochberg; Jane C. Stutts; Donald W. Reinfurt
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C.
Contract DOT-HS-4-00897
1976; 98p 24refs
Availability: Reference copy only

HS-801 941

ON THE VARIANCE ESTIMATE OF A MANN- WHITNEY STATISTIC FOR ORDERED GROUPE DATA

Two consistent estimators are given for the variance of a Mann-Whitney type statistic used for comparing two popula- tions based on samples grouped into ordered response catego- ries. The first estimator is based on informative functionals, while the second estimator is based on the Delta method fol- lowing the GSK approach and its generalization. Application of the estimators to data concerning injury severity by group drivers in left side impact is provided to illustrate the effec- tiveness of the methods. Use of the estimators with data from

HS-801 942

large samples provides a useful confidence interval for the statistician.

by Yosef Hochberg
University of North Carolina, Hwy. Safety Res. Center,
Chapel Hill, N.C.
Contract DOT-HS-4-00897
1975; 14p 13refs
Availability: Reference copy only

HS-801 942

SURVEY 2 OF SUSPENSION SYSTEMS ON MOTOR HOMES. VOL. 12. FINAL REPORT

Loading patterns, load capacities, and consumer knowledge in these areas were determined for analysis of suspension systems on motor homes. These data were compared to results from a previous survey in an effort to determine what improvements were made in suspension systems due to industry and government action. Vehicles were weighed as loaded for traveling and the suspension rating data were obtained from the vehicle manufacturers. Results show significant improvements in manufacturer's response to results of a previous survey and to new safety regulations. Although overall measured vehicle weights are higher, the number of suspension components being used beyond their recommended capacities was substantially lower, while average calculated owners payload was practically the same. This was accomplished through the use of higher capacity components and by providing owners with more adequate information concerning vehicle capabilities. Industry is advised to make an effort to eliminate the small number of suspension problems remaining, before government action is necessary.

by Norman Ludtke
Pioneer Engineering and Mfg. Co., Warren, Mich.
Contract DOT-HS-4-00978
Rept. No. S4-55A; 1976; 164p
Availability: NTIS

HS-801 943

A CONTEMPORARY OVERVIEW OF TRAFFIC LAW UNIFORMITY IN THE UNITED STATES: 1968-1974

Although a consensus prevails as to existence of dissimilarities in State traffic laws, there are few studies which pinpoint the nature and extent of traffic law inconsistencies existing. Two commentaries on State traffic laws (1968, 1974) have been studied and compared with provision for drafting uniform traffic laws in the Uniform Vehicle Code (UVC). The data derived from the commentaries compared with the UVC indicate that there was measurable progress in 10 of 13 UVC categories over the six-year period investigated. Improvement areas noted include laws relating to traffic signs, signals, and markings; overtaking and passing rules; right of way; speed restrictions; and bicycle and motorcycle laws. States cited as outstanding in improvement in relation to UVC recommendations are Georgia, Maryland, and Nebraska. Kansas was rated as the national leader in traffic law uniformity. Continuing im-

HSL 76-11

provement in State traffic laws toward uniformity is advocated.

by Walter J. Norbet
National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Programs
1976; 122p
See also HS-820 262.
Availability: NHTSA

HS-801 944

TRENDS IN DRINKING-DRIVING PATTERNS AT NIGHT. A COMPARISON OF THE FIRST THREE ROADSIDE SURVEYS OF THE FAIRFAX ALCOHOL SAFETY ACTION PROJECT. FINAL REPORT

Three nighttime roadside surveys of random drivers were conducted in Fairfax, Virginia, to evaluate the effectiveness of the Fairfax Alcohol Safety Action Program (ASAP) in reducing the incidence of driving while under the influence of alcohol. The survey program compares the findings of the three surveys with particular emphasis on the blood alcohol concentration of sampled drivers at three points in the safety program: January 1972, prior to its operational beginning in February 1972, October 1972, and October 1973. The baseline survey showed that significantly more people drink on weekends than on weeknights, but no differences were recorded in the number who were drunk. In all three surveys, the largest percentage of respondents sampled were in the 20-29 age bracket, caucasian, male, and residents of the Fairfax ASAP area. The survey found that four out of five motorists surveyed drink beer, wine, or liquor, that beer was the most preferred beverage, followed by liquor and wine in that order, and that on all three surveys, about three-fourths of the respondents classified themselves as either very light or fairly light drinkers, about one-fourth as moderate drinkers, and only about two percent as either fairly heavy or heavy drinkers. In view of the breath test results, this question demonstrated that many people tend to underestimate their alcohol consumption. Survey results of drinking and driving by time of day are included. Results indicate that the safety program has had a measurable impact in raising public knowledge regarding drinking and drunken driving as well as modifying the drinking/driving behavior of several target populations.

by Thomas J. Smith
Virginia Hwy. Res. Council
Contract DOT-HS-067-1-087
1974; 34p 2refs
Sponsored by Hwy. Safety Div. of Virginia.
Availability: Reference copy only

HS-801 945

DRINKING-DRIVING PATTERNS AT NIGHT. BASELINE ROAI SIDE SURVEY OF THE FAIRFAX ALCOHOL SAFETY ACTION PROJECT. FINAL REPORT

A baseline survey of nighttime drinking/driving patterns in Fairfax, Virginia, was performed in order to ascertain such patterns prior to the start of the Fairfax Alcohol Safety Action Program. The purpose of the preliminary survey is to provide a secondary measure of the effectiveness of the safety program in reducing incidence of driving while under the influence of alcohol. The survey was conducted during 11 nights

r 30, 1977

HS-801 953

1972, at three sites each night. At each site most stopped at random and asked to answer a short questionnaire and to provide a breath sample for a determination of blood alcohol concentration. Findings indicate that the sample tested do drink alcoholic beverages, and 90% of these registered significantly positive blood alcohol concentration. Characteristics of drinking/drunken drivers are noted for the various time periods utilized in the testing that early morning hours (12:40-3:00 A.M.)

the greatest percentage of drinking/drunken drivers, the time period 7-9 p.m. the second highest. There was more drinking on weekends than on weeknights. The average age of drivers was 32-35 years with the largest group being in the 20-29 age group. Of the drivers 51.6% were male and 94.3% were white. Only 19% of the drivers were able to pick out the presumptive limit for blood alcohol intoxication. Among other facts presented are that the group of drivers under 20 was significantly underrepresented in terms of drunken drivers and the age group 30-39 was significantly overrepresented. Of the male drivers 5.1% were compared with only 0.7% of females; 3.9% of all drivers were drunk compared with 11% of all black drivers. The more miles a person drives a year the more likely he will be drunk. Beer drinkers were more likely to be drunk than wine or liquor drinkers.

J. Smith

Vy. Res. Council, Charlottesville, Va.
OT-HS-067-1-087

VHRC-73-R34; 1974; 36p 9refs
by the Virginia Hwy. Safety Div.

Availability: Reference copy only

TESTING OF 2-D ANTHROPOMORPHIC DUMMY ("OSCAR") AND 3-D ANTHROPOMORPHIC DEVICE (H-POINT) IN RELATION TO HEIGHTS AND BODY WEIGHTS OF AMERICAN DRIVERS

From drivers' licenses, military physical measurements, and census data as a guide in estimating the size range of the population, it was concluded that the two title devices for seats and seat materials for automobiles should be selected to provide a greater range of differences in both size and weight. It was argued that the range of vision and distance from the seat to the pedal could vary considerably in drivers of the different heights. The supplied data indicate that a revision of the H-Point is specially needed at the lower limit of measurement.

Recommendations are required concerning at least the potential driver population, with subgroup data kept separately so that changes can be made without repeating an entire anthropomorphic survey.

Dr. Hoyme; P. S. Gindhart
Services, P.O. Box 1774, Hyattsville, Md. 20788
NHTSA-6-5262

74refs

by: Corporate author

HS-801 947

RSV PHASE 2. BI-MONTHLY PROGRESS REPORT NO. 6, MAY 17, 1976 TO JULY 16, 1976

During the reporting period the contractor completed fabrication of all Build 3 RSV test articles, and began performing full-scale crash tests to consider occupant protection. In the three test series conducted (weight, cost, and accident analysis), the RSV structure and restraints performed well, allowing anticipation of good occupant protection capability in remaining tests scheduled. The major problem area reported concerns the difficulty and slowness in fabrication of remaining scheduled test articles, while attempting to minimize expenditures during the remainder of the program without compromising fabrication of Build 4 and 5 test articles. Progress and problems in vehicle systems development and fabrication, structural design and development, and restraint system development are also reported.

Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017

Contract DOT-HS-5-01215

Rept. No. PR-6 ; 1976; 350p

Availability: Reference copy only

HS-801 951

OPERATION AND MAINTENANCE MANUAL FOR TEST DUMMY SA103C

This operation and maintenance manual for the three-year-old size SA 103C dummy is presented with a complete set of technical specifications including drawings, assembly drawing information, and photographs. Information is given for the following areas: external anthropometry; weight distribution; motion ranges; articulation joint design; instrumentation capabilities; use and storage recommendations; joint friction adjustments for rubber elements, ball joints, sleeve and bushing joints, and clevis joints; head segment; neck; torso segment; upper and lower legs; feet, upper arms and forearm-hand assemblies.

Alderson Res. Labs., Inc., 390 Ludlow St., Stamford, Conn. 06904

Contract DOT-HS-6-01294

1976; 78p

Includes a listing of Data Package items, technical drawings and a packing list.

Availability: Reference copy only

HS-801 953

EFFECTIVENESS OF VARIOUS SAFETY BELT WARNING SYSTEMS. FINAL REPORT

Overall objectives of this observation study among rental car users at Sky Harbor Airport, Phoenix, Arizona were: to determine if the warning system now required on 1975 and 1976 cars is effective in increasing safety belt usage; and to determine the effectiveness of various other types of warning systems allowable under P.L. 93-492. Study phases consisted of the following: select study site and obtain cooperation of rental car agencies and airport officials; recruit and train field personnel; modify and equip rental cars with various warning systems; observe and record safety belt usage in returning rental cars over a 19-week period; and inspect returning cars to determine that the various systems were operating properly. Results show that the present system required by Standard 208

HS-801 954

is not effective in increasing safety belt usage. Most effective system for increasing usage is one that includes, in addition to the present equipment; a reminder light that does not go off unless the belt is fastened; and a sequential logic system that requires the driver to first sit on the seat and second to buckle the belt.

by Albert Westefeld; Benjamin M. Phillips
Opinion Res. Corp., North Narrison St., Princeton, N.J. 08540
Contract DOT-HS-5-01154
Rept. No. 51330; 1976; 27p
Rept. for May 1975-May 1976.
Availability: NTIS

HS-801 954

ACCIDENT-AVOIDANCE CAPABILITIES OF MOTORCYCLES. APPENDICES. FINAL REPORT

Four appendices providing additional details on subjects discussed in the technical report are presented. Appendix A contains descriptions of the two detailed test procedures used in the study: constant speed directional control, and lane changing. Appendix B is a collection of all printed and plotted output from the tire performance measurement tests performed at the Calspan Tire Research Facility. Appendix C consists of a full set of machine-plotted responses of the principal input and output quantities from the directional control test procedure in the simulation study. Appendix D contains data from the full-scale tests with the Honda CB 360 motorcycle, including typical raw data time histories for both procedures.

by Roy S. Rice; James A. Davis; Dennis T. Kunkel
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221
Contract DOT-HS-4-00976
Rept. No. ZN-5571-V-2; 1976; 169p
1 Jul 1974-30 Jun 1975. For Technical rept., see HS-801 810.
Availability: NTIS

HS-801 962

THE NEW HAMPSHIRE ALCOHOL SAFETY PROJECT: AN EFFECTIVENESS EVALUATION

The effectiveness of the New Hampshire Alcohol Safety Action Program (ASAP) is evaluated in terms of its impact on the reduction of alcohol related crashes occurring during the demonstration period, January 1972 through December 1974. The Box-Jenkins Time Series Analysis technique was used to evaluate the impact of ASAP, particularly by Intervention Analysis. Two factors were considered in the analysis: uniqueness of the intervention and impact variable change occurring uniquely in the demonstration area. Application of the analysis techniques to the ASAP evaluation problem is described in terms of data development, methodology, problems of application, and results. Results show that an intervention (by ASAP) did occur in the state and that it had significant impact in reducing crashes related to alcohol. Graphs are provided for New Hampshire night and day fatal crashes, fuel consumption, and alcohol related arrests; and the national trend in night fatal crashes.

by Paul S. Levy; Terry M. Klein
National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Programs, Washington, D.C.
1976; 20p 5refs
Technical note.
Availability: NHTSA

HS-801 967

AIR BRAKED VEHICLE PERFORMANCE: FMVSS NO. 121 BRAKING SYSTEMS VERSUS PRE-FMVSS NO. 121 BRAKING SYSTEMS AND STABILITY AUGMENTATION DEVICES

Road tests were conducted on three truck tractors and four semitrailers to evaluate effects of Federal Motor Vehicle Safety Standard (FMVSS) No. 121, Air Brake Systems. Trucks, Buses and Trailers, on braking system performance. Tests were run in accordance with procedures specified in the standard and also in accordance with other test procedures developed during the course of the program to simulate typical on-highway emergency situations. The use of three different stability augmentation devices on tractor-trailer combinations was also evaluated to determine if these devices affected vehicle braking performance. A description of the test program and an analysis of the results are presented, including descriptions of test vehicles, instrumentation, and the test site; detailed data sheets; performance summaries; and a discussion of results. Results indicate that the FMVSS 121 systems provided superior braking performance to pre-FMVSS 121 systems, and in addition, that the use of the three stability augmentation devices evaluated would not upgrade pre-FMVSS 121 system performance to that of a FMVSS 121 system.

by Richard W. Radlinski
Safety Res. Lab., 6501 Lafayette Ave., Bldg. 2, Riverdale, Md. 20840
1976; 305p 2refs
Final report Jun-Dec 1975.
Availability: NHTSA

HS-801 974

PSYCHOLOGICAL AND SOCIODEMOGRAPHIC CHARACTERISTICS OF ACCIDENT INVOLVED DRIVERS: A SURVEY OF THE LITERATURE

A review is made of selected portions of the literature concerning the psychology of negligent driving. In particular, it stresses those studies which attempt to quantify and predict aberrant driving behavior. Reviewed are such topics as the role of demographics and driving records in accident occurrence and accident proneness, and the use of personality factors in predicting driving behavior. Areas of consideration include the theory of accident proneness, the factor of life change or stress, and personality factors. Accident proneness cannot be considered an explanation of accident victim selection. Although there is a relationship between accident occurrence and high life stress, it is not strong enough to allow for useful prediction. Studies of personality factors do not offer evidence of predictive ability but do suggest that traits such as aggression, hostility, alcohol addiction, and psychopathological and sociopathological problems are over-represented in the negligent-driver population. Recent work seems promising in light of the multivariate techniques being introduced which will aid in the area of relevant variable identification and method

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for use in individual driver examination and in safety in general.

I W. Lynn
Hwy. and Transportation Res. Council,
Richmond, Va.
DOT-HS-067-1-087
VHTRC-76-R49; 1976; 20p 51refs
Developed jointly by the Virginia Dept. of Highways and
Transportation, and the Univ. of Virginia.
Availability: NTIS

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ACCIDENT REDUCTION THROUGH CEMENT. THE IMPLEMENTATION OF A REACTION NATIONWIDE SAFETY TEAM

The Accident Reduction-Enforcement (FARE) program was established to reduce highway fatalities by providing funds for overtime payments to police officers to carry out selective enforcement efforts at times and places with the largest number of fatal crashes. The evaluation data collected from 17 states are summarized, a description of the program planning and operation is given, and a discussion of special enforcement programs that have been tried in the past is included. Although there is need for additional research, past programs do give some evidence that increased enforcement accompanied by adequate public information and programs can influence driver behavior and result in a decrease in crashes. Ninety-five percent of the FARE funds were used for police overtime payments. This increased the number of citations, and forty of the forty-six states reporting a decrease in fatal accidents. However, due to a lack of control sites it could not be determined whether this decrease in fatalities was due to the FARE program or influenced by other factors such as road improvements, traffic changes, the fuel crisis, weather, or chance. The program's impact might have been enhanced if it had intensive publicity including letting the public know where it was in effect, timed to take advantage of naturally occurring events like the fuel crisis, and concentrated on one type of behavior like not exceeding the speed limit.

Developed by: Voas; M. A. Ruzecki; R. A. Youngs
National Highway Traffic Safety Administration, National Hwy.
Safety Administration, Washington, D.C.
33p 35refs
Availability: Corporate author

007

IMPROVING THE LIMITING PERFORMANCE OF MOBILE STRUCTURAL COMPONENTS UNDER CRASH CONDITIONS. FINAL REPORT

The limiting performance technique is used to study optimum performance characteristics of automobiles in collisions. The technique approximates the physical model (structural components and isolator forces) of an automobile with a mathematical model, so that the equations of motion describing the system include incompletely specified elements. The performance characteristics are determined in the process of optimizing a response performance index. Analytical solutions of mass automobile models impacting into a barrier are used for validation of computational performance results.

Minimum crush distance was calculated to satisfy passenger survival criteria. The solutions obtained indicate that better passenger protection can be achieved through improved connection of compartment and front suspension components. Restraint system deployment time also affects crashworthiness of vehicles. Numerical results indicate that increasing available internal distance for a passenger and/or available crush distance can make smaller cars more crashworthy. Findings of analyses performed using the computer programs PERFORM and REFORM are discussed, indicating their limitations from representation of generic forces as piecewise constant between discretized time intervals and applicability only to quasilinear dynamic systems. An improved computer program called NLPERFORM is introduced, but is limited in use by the substantial amount of computer running time required. Piecewise linear representation of generic forces in use of PERFORM or REFORM, application of limiting performance analysis to large-scale automobile models, and use of early warning devices to minimize passenger deceleration are recommended for further study.

Developed by: S. Chander; W. D. Pilkey
Control Data Corp., Professional Services Div., 6003
Executive Blvd., Rockville, Md. 20852
Contract DOT-HS-6-01335
1976; 131p 12refs
Rept. for Dec 1974-Dec 1975.
Availability: NTIS

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